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The effect of headphone music on exercise compliance

Gayle Ann Laszewski
University of the Pacific

The Effect of Headphone Music on Exercise Compliance

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Abstract

A study was designed to assess the effect of headphone music on running performance and enjoyment with its implications for increasing exercise compliance. A counterbalanced split-plot design was used with 18 University of the Pacific undergraduates receiving both treatment conditions: running with music and running without music. Measures included: (a) perceived enjoyment questionnaire scores; (b) running time; and (c) heart rate. It was expected that music would increase participants' rated running enjoyment, amount of time spent running, and also running intensity or heart rate, in comparison to running without music. Music significantly increased participants' rated enjoyment scores but not running time or heart rate. A tendency for participants to run longer when they rated the run as more enjoyable was also observed although the obtained Pearson r was not significant at the $p = .05$ level.

The Effect of Headphone Music on Exercise Compliance

The value of implementing physical activity into one's lifestyle has been attributed to a number of physiological and psychological effects. Some of the attributed physiological effects of exercise reviewed recently by Leon and Fox (1981) include: reduced hypertension, weight control, improved tolerance to stress, increased efficiency of the cardiorespiratory system, and reduced risk of coronary heart disease. Psychological benefits that can be associated with exercise include: reduced depression and anxiety (Greist, Klein, Eischens, Faris, Gurman, & Morgan, 1979), enhanced feelings of well-being (Dishman, Ickes, & Morgan, 1980; Morgan, 1981), and improved self-image (Joesting, 1981; Pollock, 1979).

Cooper (1977) and the American College of Sports Medicine (1978), on the basis of research on the efficaciousness of varied levels of exercise, emphasized improving and maintaining fitness through regular aerobic activity at least 3-5 times per week for 15-60 min, at an intensity of 60-90% of maximum heart rate. Zohman (1974) notes that cardiorespiratory fitness deteriorates quickly when exercise is stopped or decreased. "If one decreases frequency of exercise to once per week, one-half the fitness level gained will be lost in 5 weeks" (Zohman, 1974, p. 23).

The success of persons engaging in regular exercise and, more importantly, in maintaining exercise as a lifestyle habit, has been limited. Fifty percent of individuals who begin an exercise program

will dropout within the first 6 months (Dishman, 1982). Serfass and Gerberich (1984) have reported dropout rates as high as 87% from exercise programs. Even if benefits can be derived from exercise, its total effectiveness cannot be realized until it is incorporated into a person's daily life.

The concern over the importance of regular exercise and the problem of adherence has caused researchers to investigate the factors contributing to dropout from exercise programs. Factors related to exercise program dropout include: inflexible hours, inconvenient location of the exercise facility, and lack of enthusiastic instructors (Andrew et al., 1981; Andrew & Parker, 1979), lack of support by the spouse (Serfass & Gerberich, 1984; Andrew et al., 1981), perceived lack of time and lack of variety in exercise options (Shephard, 1985), and fatigue and perceived exertion (Perry, 1987).

In looking at the positive and negative aspects of exercise, persons will avoid those activities which are aversive and engage in those which are enjoyable. More specifically, the sensations associated with exercise, either positive or negative, will influence a person's reaction to exercise. Dishman, Sallis, and Orenstein (1985), have suggested that a high ratio of enjoyable exercise experiences, sensations, and cognitions, compared to neutral or aversive experiences, must be present if exercise is to become a lifestyle habit. For example, persons who are addicted to exercise and feel they must run or exercise daily generally have pleasurable associations to exercise (Glasser, 1976). One such association is the "runner's high."

This high has been described as a sense of euphoria or well-being. It has been suggested by a number of studies that the runner's high is the result of increased blood levels of the chemical compound endorphins. "Endorphins are thought to have a morphine-like effect, masking pain and producing euphoria" (Stamford, 1985, p. 166). However, other research has shown that the runner's high can occur without an endorphin level increase. This suggests that mental diversion may be an important factor. Stamford (1985) explains that the runner's high usually occurs with experienced runners and those who disassociate their mental thoughts from running. These diversions then allow them to escape from the pain and discomfort accompanied with running.

Stamford (1985) suggests that novice runners may also be able to achieve the runner's high. A key factor appears to be the ability to relax while running. Another factor associated with the runner's high is endurance, that is, most runners experience this high after they have run several miles. Diverting one's thoughts away from the exercise activity and inducing relaxation then, appear to be two factors which novice runners can use to enhance their exercise experience until they can endure a longer run.

On the negative side of exercise, persons who experience aversive sensations from exercise will avoid exercise or will not exercise at an efficient level. Besides the pain and discomfort associated with beginning an exercise program, a person may also experience boredom or monotony from an exercise routine. Kodzhaspirov (1984) reports that one of the factors that interferes with developing an effective

training workout for athletes is monotony. He states that as a result of the development of monotony in athletes, there is "untimely or early fatigue, poor attention and watchfulness, a feeling of uncertainty and overestimation of time intervals (time drags on 'forever'), excessive excitability, nervousness, anxiety..." and on the physiological side, "a decrease in the activeness of the heart-circulatory, respiratory, and other systems" in the body (p. 105). Kodzhaspirov also observed that the more the athletes experience positive sensations during training, the better they execute their training tasks. Perry (1987), in investigating the causes of dropout in adult exercise programs, also found that fatigue and perceived exertion were two important factors.

Distraction or mental diversion may enhance the exercise experience by allowing exercisers to escape from the negative sensations associated with exercise: muscle soreness, boredom, fatigue and exertion. Morgan (1978) used the term "dissociation" to identify the coping strategy used by runners when they think about anything else but their bodily sensations. Morgan (1978), in his work with Boston marathoners, found that when the runners were confronted with pain, they would begin to think about something else to distract themselves. This enabled them, apart from their physical abilities, to complete the marathon. Some even excelled beyond their previous performance times or broke records in this dissociated state of mind.

Pennebaker and Lightner (1980) assessed the impact of internal sensory and external environmental cues present in an exercise setting on participants' physical performance. They found that subjects

hearing distracting sounds while exercising on a treadmill reported less fatigue and fewer symptoms than subjects hearing an amplification of their own breathing. In a second experiment, they found that subjects jogging on a cross country track (external cues; attention is focused toward the stimulating environment) versus lap courses (internal cues; attention is focused from the non-stimulating environment to bodily sensations) of equal lengths ran at a faster rate, although perception of fatigue did not differ between the two conditions. This suggests that by reducing the processing of internal cues, an individual can increase his or her pace without feeling maximally fatigued.

Often research employing distraction strategies to endurance exercises has used such imagery activities as: solving mathematical problems, lying on the beach, building a house, playing a stack of phonograph albums, focusing on an object, or whatever else is enjoyable to the individual (Weinberg, Smith, Jackson, & Gould, 1984).

Music Effects

Music is widely used by individuals engaging in exercise, although there is little research on its effect. The development of TV and videotape exercise programs with music accompaniment and the use of portable tape players by runners are two most visible aspects of this phenomenon. Music has been documented as an effective distractor, pain suppressor, and relaxation agent in a wide variety of situations (Curtis, 1986).

The effects of music on behavior have been investigated from both

a physiological and psychological point of view. Most research has focused on inducing relaxation or reducing anxiety and has used psychological scales, questionnaires, and such physiological measures as galvanic skin response, heart rate, and electromyograms. The literature has shown inconsistent results in demonstrating that music produces changes in physiological measures (Dainow, 1977), and a listener's musical preference appears to be relevant to finding consistent physiological responses to music (Stratton & Zalanowski, 1984).

Music has an immediate effect on cognitive processes. Music has been described as producing a "meditative state in that senses seem to be modified enabling a person to separate thought from being, thereby eliminating the sensations of pain and noise within their surroundings" (Bacharach, 1985, p. 11). Music can alleviate the fear and anxiety of pain experiences while refocusing one's thoughts on more pleasurable experiences and can produce an emotional and physical release of tension through its soothing qualities (Bailey, 1986).

Music has been found to be an effective distractor, pain suppressor, and relaxation agent in a variety of medical, dental, and clinical settings. Standley (1986), in a review of the literature relevant to music in medical/dental settings, described a variety of applications. Music has served as a distractor in dental procedures by masking the sound of the dental drill and focusing one's thoughts away from the dental operation (Long & Johnson, 1978). Hanser, Larson, and O'Connell (1983) found that music could be used in addition to Lamaze exercises

to reduce pain and length of labor during child birth. Music has also been used to reduce anxiety in the operating room (MacClelland, 1979) and to reduce the amount of pain relieving medication given to postoperative patients (Locsin, 1981). Wolfe (1978) demonstrated that pairing music with chronic pain exercises resulted in increased duration and frequency of these exercises by patients in a pain rehabilitation clinic.

Music and Exercise

Music may facilitate exercise in several ways: to distract one's attention from the pain and discomfort associated with exercise and from the boredom of repetitious exercise activity, and to promote relaxation which allows for an easier execution of exercise movements. Music could serve as a distractor to divert one's attention from the pain and discomfort associated with exercise such as perceived exertion, distance of the run, and muscle soreness. Research on perceived exertion while exercising offers implications for the use of music to increase compliance. Tejwani, Miller, Vaswani, and Kirby (1985) studied the effects of stereo headset music on 9 men, aged 19-30, during 30 min treadmill runs both with music and without music. Measuring heart rates, perceived exertion, lactic acid and endorphin levels, he found that both the beta-endorphin and perceived exertion levels were significantly lower with the music group, while the physiological stress level remained the same. Music, according to Tejwani et al. (1985), helps tune out the stressful sensory input (increased heart rate and respiration) to the body and therefore

perception of exertion. Tejwani et al. (1985) explain further that because the runners perceived the exercise as less intensive with the music, their bodies reacted by producing less of the pain killer qualities of endorphins. This finding has specific relevance for maintaining compliance, since one of the most frequently cited reasons a person drops out of an exercise program is from fatigue and perception of exertion.

Music might also distract attention from the boredom of repetitious activity by providing continuous stimulus change. This may be especially pertinent for the individuals who lack the time or access to attend a fitness center and must rely on their own motivation or must exercise in undesirable exercise conditions such as heat, cold, altitude, and non-scenic environments.

Music could also serve as a relaxation agent, allowing easier breathing, a smoother running stride, which in turn could make running a more enjoyable experience. Jerome (1985), in his research on athletic training to music, found that music provides a consistent background from which to work on timing of athletic motion. He states that the part of the movement that requires the most energy and directs our attention is initiation. He proposes that music can help organize our initial efforts so that once persons start repeating a motion to the beat of a song, they can redirect their thoughts to other parts of the motion because the initiation part becomes automatic. Jerome (1985) also explains that music causes one to perform motions with more of a ballistic or throwing quality, making for shorter,

sharper muscular contractions followed by coasting. This allows the muscles more time in coasting to replenish new energy. Coordinating these moments of relaxation or coasting with the down beats (between the beats) of the music can then help one achieve a more energy efficient motion. Therefore, using music with exercise may facilitate relaxation and an easier execution of the activity, which may result in a more enjoyable exercise experience.

Brody (1988) has written on the popularity of using music with exercise. He has emphasized that music can be used to: "encourage you to stick with an exercise program and deepen your pleasure in doing so, lower fatigue and pain enough to make you push harder with apparently less effort, boost stamina, regulate your breathing, and promote better muscle coordination" (p. F-1). Brody cites a number of athletes that have used music in their training workouts and before competitions. Olympic triple jumper Willie Banks for example, set an indoor and outdoor world record shortly after listening to specific songs and he states that "the music helps get my movements in a groove. It relaxes me so I can tune out distractions" (p. F-1). According to Brody, NASA plans to provide future astronauts with personal music tapes and headsets to accompany their required 90 min daily bicycle ergometer workout while in space. NASA flight surgeon Donald Stewart, M.D., says "Music is a diversion that makes exercise less tedious, more pleasant." He sees music as "an extra incentive to exercise, and as a way to ensure compliance with a routine" (p. F-1).

An especially relevant use of music with exercise is in the initial

stages of an exercise program. Mental diversion, distraction, or dissociation has particular implications for the beginning runner who must, first of all, overcome the pain and discomfort associated with starting an exercise program, and secondly, obtain an effective level of exercise to gain its positive consequences. Music could provide immediate enjoyment to the individual until an effective level of exercise is achieved, and the exercise benefits themselves are enjoyable through such outcomes as: increasing one's fitness level and health, weight-loss, and promoting feelings of well-being.

My study examined the use of headphone music to increase the enjoyment, duration, and intensity of running. Emphasis was placed on: (a) obtaining an effective level of running, exercising at 60-90% maximum heart rate (target heart rate range) at a duration of 15-60 min and (b) increasing the perceived enjoyment of running. The following three hypotheses were tested: (1) Running with music would enhance perceived enjoyment of the exercise, (2) running with music would increase the amount of time spent running, and (3) running with music would increase the intensity (increased heart rate) of the exercise activity (since individuals' perception of exertion will be lower with music), in comparison to running without headphone music.

Method

Subjects

Eighteen subjects were recruited from a heart, nutrition, and exercise class at the University of the Pacific as part of a class requirement. Subjects were chosen on the following criteria: (a) no

prior experience running with headphone music; (b) no more aerobic activity than three times per week or for more than 60 min in duration; and (c) no medical condition which would pose a danger when running (e.g., heart condition, asthma, high blood pressure, etc.) based on a self-reported medical history and informed consent form (see Appendix A).

Measures

All subjects were assessed for: (a) duration of their run in terms of minutes; (b) heart rate per minute taken manually using their carotid pulse, one of the most reliable heart rate methods (K. Spracher-Bristol, personal communication, December I, 1987); and (c) their perceived enjoyment of running using a questionnaire. The perceived enjoyment questionnaires were scored by adding the point values for each question (ranging from 1 to 10), with a total of 150 possible points. Subjects were asked to run around a track inside the University's gymnasium, until "you are tired and feel you can't run anymore or until 30 min has elapsed." (For ease of recording, each participant was instructed to complete a full lap before stopping.) They were informed that a heart rate measure would be taken every 1/2 mile during the run, and after each run, they would be requested to fill out a questionnaire on perceived enjoyment of the run.

Development and Validation of the Perceived Enjoyment Questionnaire

A construct definition of perceived enjoyment and its relation to exercise was developed along with a set of 40 questions used to assess an individual's perceived enjoyment of a completed running

session. The 40 questions were then evaluated independently by four psychology graduate students and a faculty member for construct validity, i.e., how well the items fit the construct definition. The best fitting items were then selected and combined to form a 20 item questionnaire. Internal consistency of the 20 items was determined by distributing the set of items to 155 runners at a community fun run after they had completed their run. This particular fun run was selected because of the large number of participants and wide range of physical fitness levels. Coefficient alpha was then determined for the set of items (α = .96). Item-total correlations were also calculated and items with the lowest correlation were removed from the questionnaire, reducing its final version to 15 items (see appendix B).

Observers

Three observers, psychology graduate and undergraduate students, recorded the duration of 11 participants' run during an 11:00 group and two observers, a psychology graduate and undergraduate student, recorded running times for 7 participants in a 12:00 group using a stop watch. The observers also recorded the participants' self-reported heart rates. The observers were given a 90 min orientation on: (a) how to use a stop watch; (b) when to begin the timing of each run (this was the same for every observer since they were given the starting times of their participants and asked to calculate their total running duration based on their ending time); (c) when to stop timing the run (after each individual has ceased running or jogging); and (d) recording the data.

The criterion for timing each run was that the runners must be jogging or running, while the stop watch was on, with the exception of stopping to take their heart rate. Walking or stopping during any other time than taking a heart rate measure was recorded as the cessation of running. Interobserver agreement on the duration of a participant's run within a 10 s interval was calculated using the Kappa formula (see Appendix C). This statistic corrects the formula for agreement reliability by subtracting chance agreement on occurrence from both the numerators and denominators (Kent & Foster, 1977). An 80% criterion was established. If agreement was below 80% then that particular run was omitted. An additional observer was trained to: (a) disperse and collect the perceived enjoyment questionnaires and (b) assist participants in calculating their heart rates if difficulty arose.

Procedure

I initially met with all participants and administered an exercise history questionnaire which included questions on the frequency and duration of current and past exercise behavior, and whether participants had used headphone music before with exercise (see Appendix D). The amount of running an individual initiated outside of class was controlled by requesting each participant to run only within the scheduled class time. The 18 participants' running starting times were staggered individually by 1 min intervals for the purpose of reducing the group effect, the tendency for participants to continue or stop running because peers are still running or have stopped running vs.

basing their running duration on their own fatigue. Following the study, another questionnaire concerning the amount of time a participant spent listening to music in general and whether the person liked listening to music while running (see appendix E) was given during the next scheduled class lecture.

Initial Meeting

The subjects were told that "The purpose of this study is to determine the effect of music on heart rate during exercise. Using music during running may increase or decrease a person's heart rate in comparison to running without music. You will be running with and without music during the scheduled class time. We will be looking at your heart rate during the running sessions with music and comparing it with your heart rate during the running sessions without music. Since you will be running with music on some of the running sessions you will need to bring a 60-90 min cassette tape of your favorite music. Please label your tape with your name and bring it to the next class meeting. At the next class, your tape will be collected and kept here for you. You will then receive an orientation on how your tape will be used with running and what the procedures will be. First of all, however, I would like to obtain information on your past and current exercise habits. Please fill this out as honestly as possible since all questionnaires will be kept confidential and there are no right or wrong answers." A 30 min presentation on the importance of exercising at an effective aerobic heart rate and how to take a heart rate measure using the carotid artery method concluded the initial

meeting (see appendix F). I then listened to each participant's cassette tape and noted to which musical category it belonged: (a) rock and roll; (b) country and western; (c) classical; or (d) easy listening.

Orientation

Participants were selected from the class based upon the established criteria for participation and received instructions during one of the two scheduled lab times (11:00 a.m. and 12:00 noon). Each lab group received instructions on: (a) how to use the portable cassette headphones; (b) how to report their heart rate to the observer recording them; (c) the procedure for running (i.e., warm-up, running until "you can't run anymore or until 30 min has elapsed," and cool down); and (d) restricting exercise to class time only. (See Appendix G for a detailed script on the groups' instructions.)

Design

Six running sessions were conducted. The sessions occurred twice per week for 3 weeks. A counterbalanced, split-plot design was used with each of the 18 subjects receiving both treatments. The 11:00 group consisted of 11 participants and the 12:00 group had 7 participants. A within group design was employed with the order of treatment for each group being randomly assigned to each of the participants. Each participant in each group received a random order of three sessions with music and three sessions without music. This was determined by throwing a die for each participant until all six numbers were rolled to represent a sequence of numbers. The numbers

were then assigned a running condition: Numbers 1-3 received music and 4-6 received no music. The participants in each group were started at intervals staggered by 1 min and randomly received an early, middle, and late time twice. Six tags of paper with two labels of each running time, early, middle, and late, were drawn to determine the random order of running times for the six sessions starting with Session One. A flip of a coin determined which of the two sessions within each category of early, middle, and late would be first.

Results

Visual display of two performance measures, rated enjoyment scores and running times, was completed for all participants combined, each group of participants, and each individual participant, to see what differences existed in the data in relation to the treatment variable. An SPF- 2.2 ANOVA (Kirk, 1982) was then completed using all three dependent variables or measures: (a) mean enjoyment questionnaire scores; (b) mean running times; and (c) mean heart rates, to confirm the reliability of the observed differences. This analysis compared values between: (a) music vs. no music conditions; (b) 11:00 group vs.12:00 group; and (c) the interaction between music vs. no music conditions and the 11:00 group vs.12:00 group. A Pearson r was also calculated to determine whether a significant correlation existed between perceived enjoyment questionnaire scores and running duration. The level of significance for all inferential statistical analyses was set at $p = .05$.

Performance of Individual Participants

All but 2 of the 18 participants showed improvement on the perceived enjoyment questionnaire when running with music, and all but 6 of the 18 participants showed improvement in running time when running with music.

Running Duration

Consistent increases in running time with music. Participants 2, 6, 13, 14, 15, and 16 showed consistently longer running durations when running with music in comparison to running without music. Participant 2 showed longer running times when running with music: 27.7 min, 28.5 min, and 30 min vs. 27.3 min without music (Participant 2 was absent during the other 2 no-music sessions.) (see Figure 1).

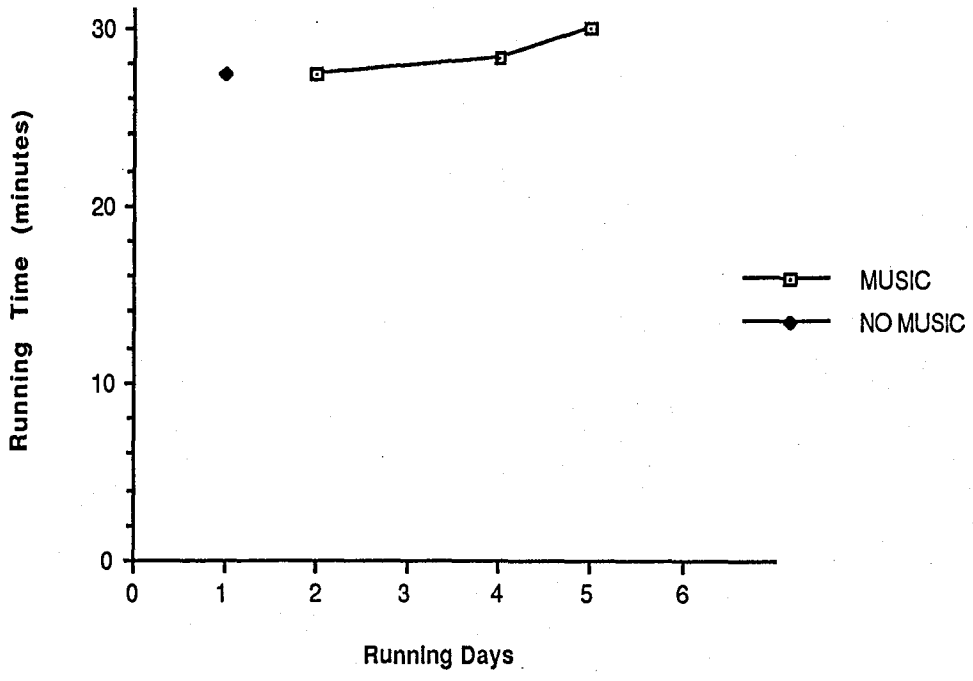

Figure 1. Participant 2's running times with and without music.

Participant 6 ran 21.2 min, 25.3 min, and 19.9 min during the running sessions with music and 19.8 min and 21 min for the sessions without music (Participant 6 was absent during one of the no-music music sessions.) (see Figure 2).

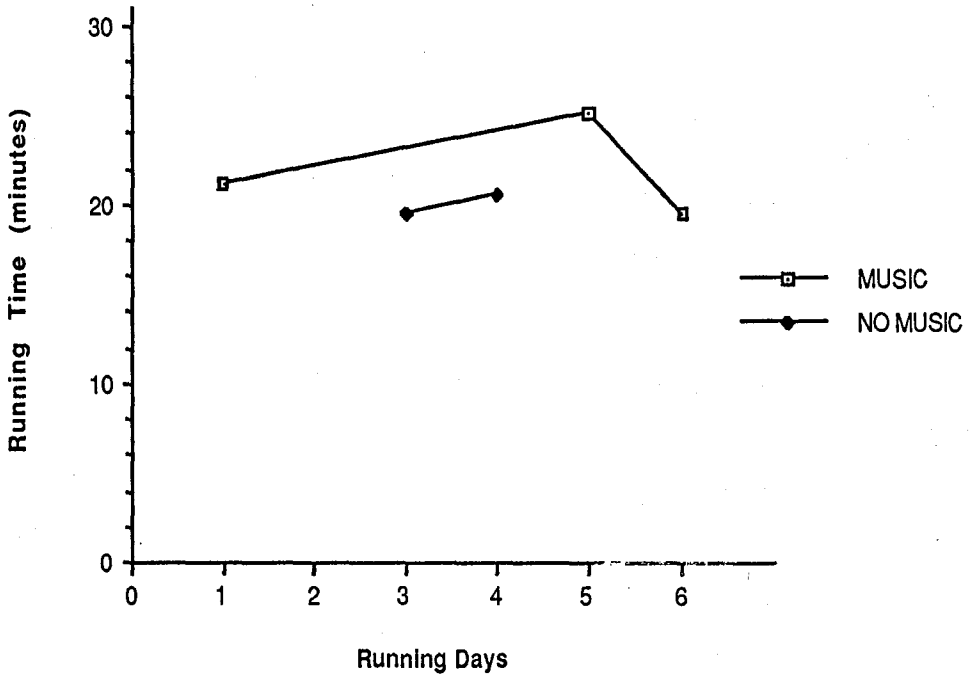

Figure 2. Participant 6's running times with and without music.

Participant 13 ran 19.4 min and 25.8 min for the music running sessions (with one day of absence) in comparison to 13.1 min, 15.3 min, and 19.3 min for the no-music sessions (see Figure 3).

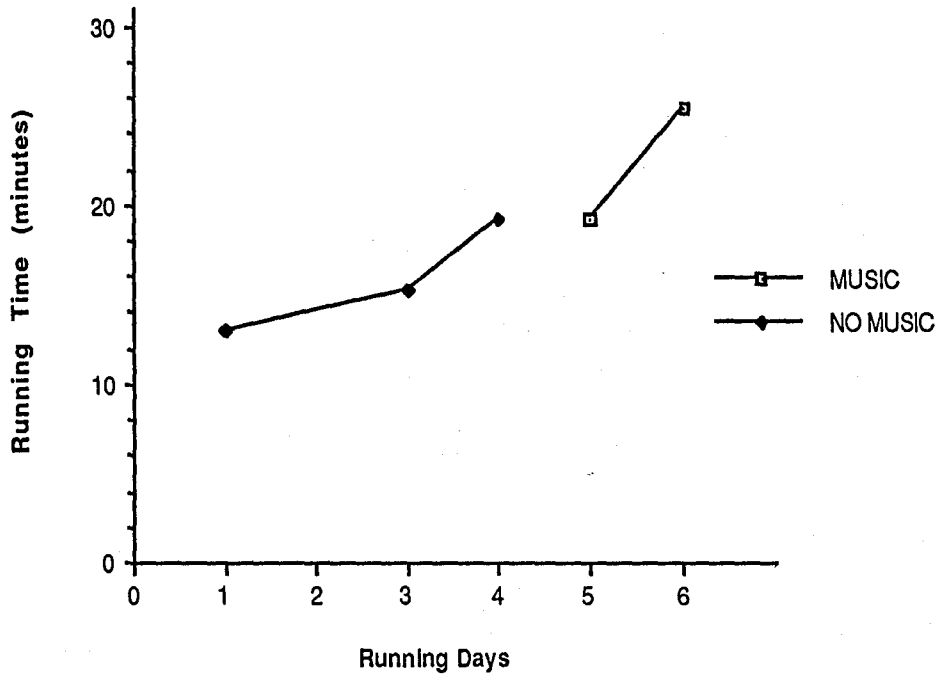

Figure 3. Participant 13's running times with and without music.

Participant 14's running times for the music sessions were 19.6 min, 27.5 min, and 19.9 min vs. 17 min, 17.9 min, and 14.4 min for the no-music sessions (see Figure 4).

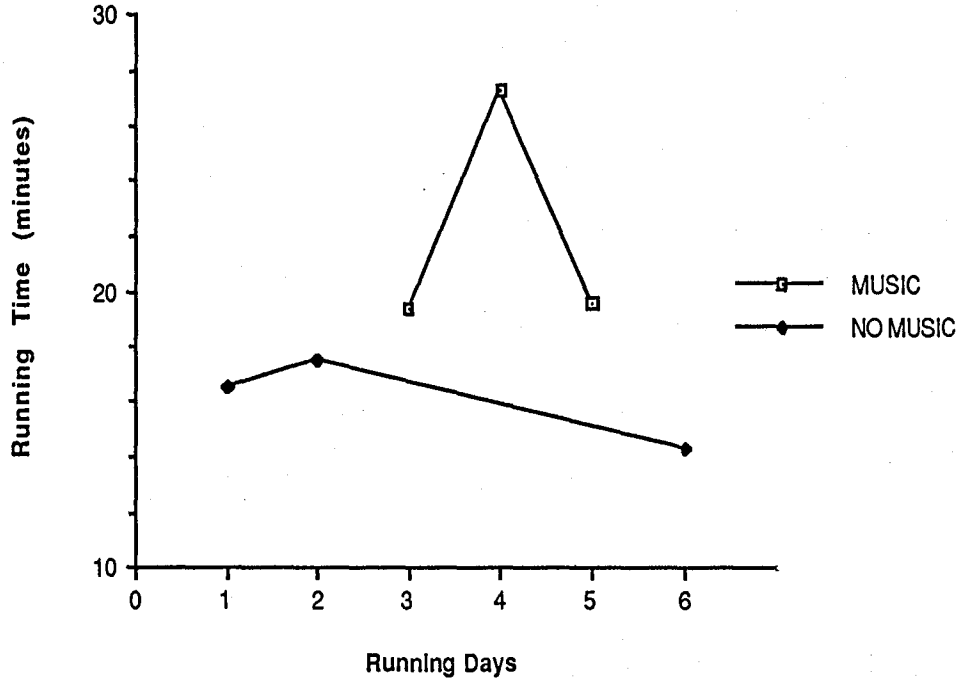

Figure 4. Participant 14's running times with and without music.

Participant 15 ran 26.4 min, 26.7 min, and 18 min during the sessions with music in comparison to running for 16.9 min, and 9.3 min (with one day of absence) for the no-music sessions (see Figure 5).

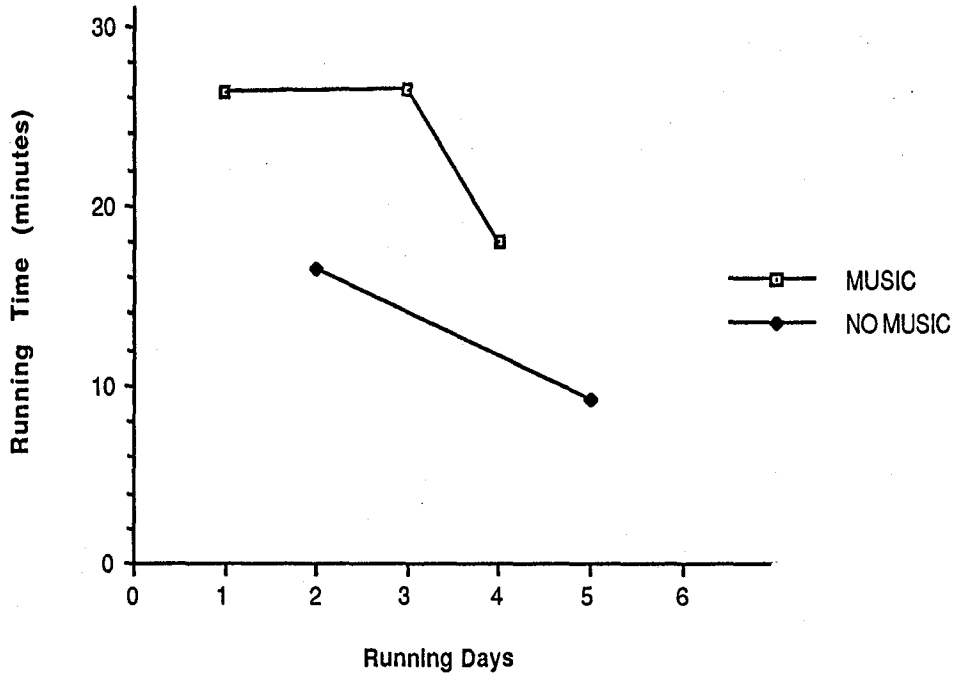

Figure 5. Participant 15's running times with and without music.

Participant 16 ran 20.7 min,19.9 min, and 19.2 min during the music sessions and 15.7 min and 17.1 min for the no-music sessions (with one absence) (see Figure 6).

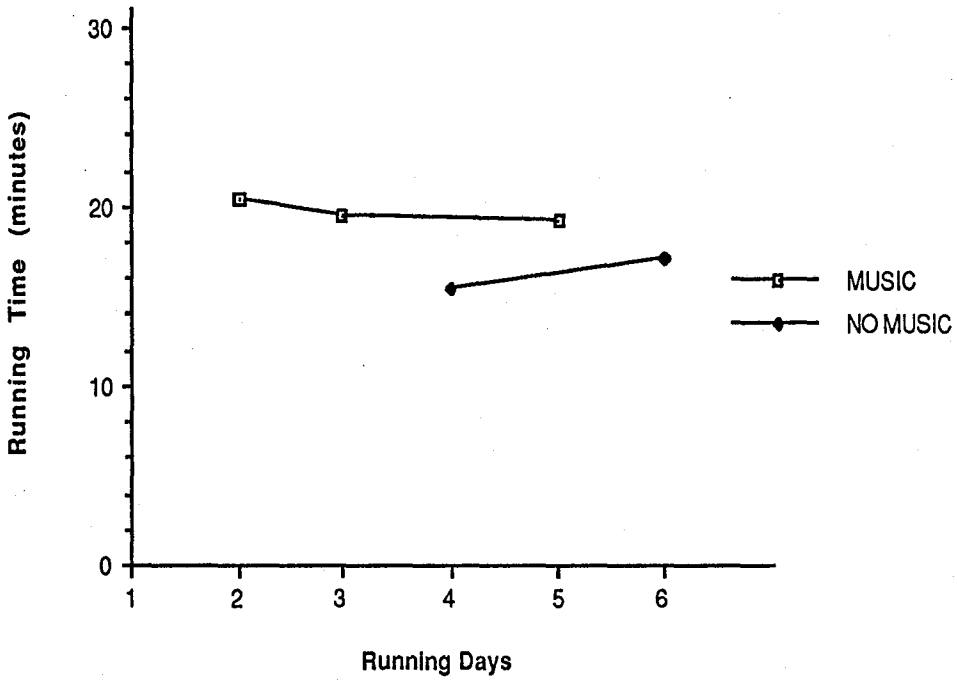

Figure 6. Participant 16's running times with and without music.

Consistent decreases in running time with music. Only three participants, 3, 5, and 18, showed a consistent decrease in running time when using music. Participant 3 ran 21.3 min and 21.2 min for the music sessions (with one absence) vs. 25.7 min, 28.3 min and 30 min for the no-music sessions (see Figure 7).

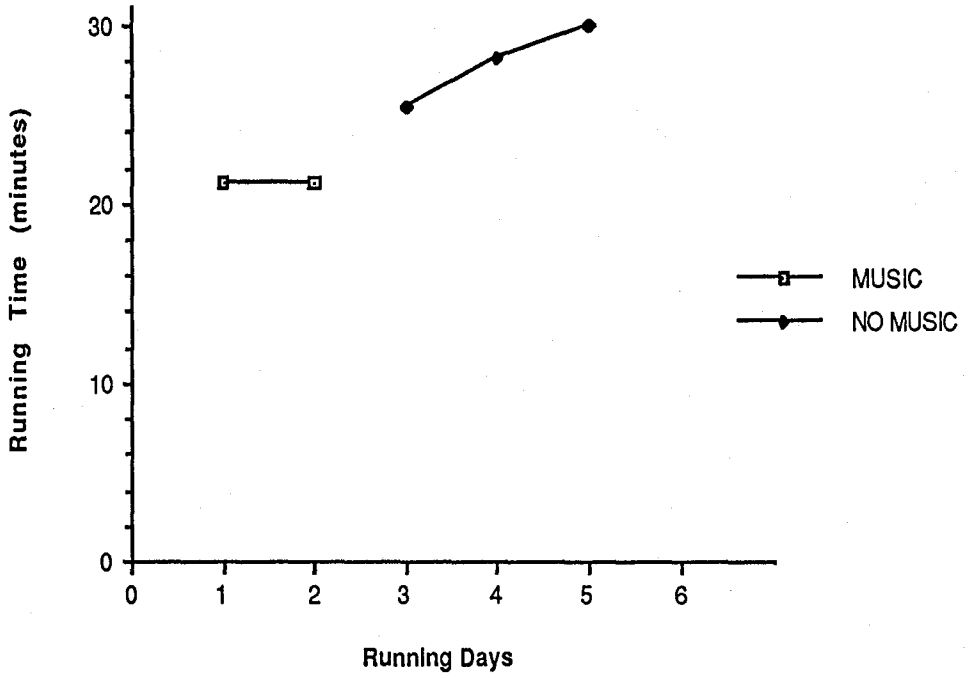

Figure 7. Participant 3's running times with and without music.

Participant 5 ran 27.3 min and 27.6 min (with one absence) for the music sessions compared to 28.7 min and 28.4 min (also with one day of absence) for the no-music sessions (see Figure 8).

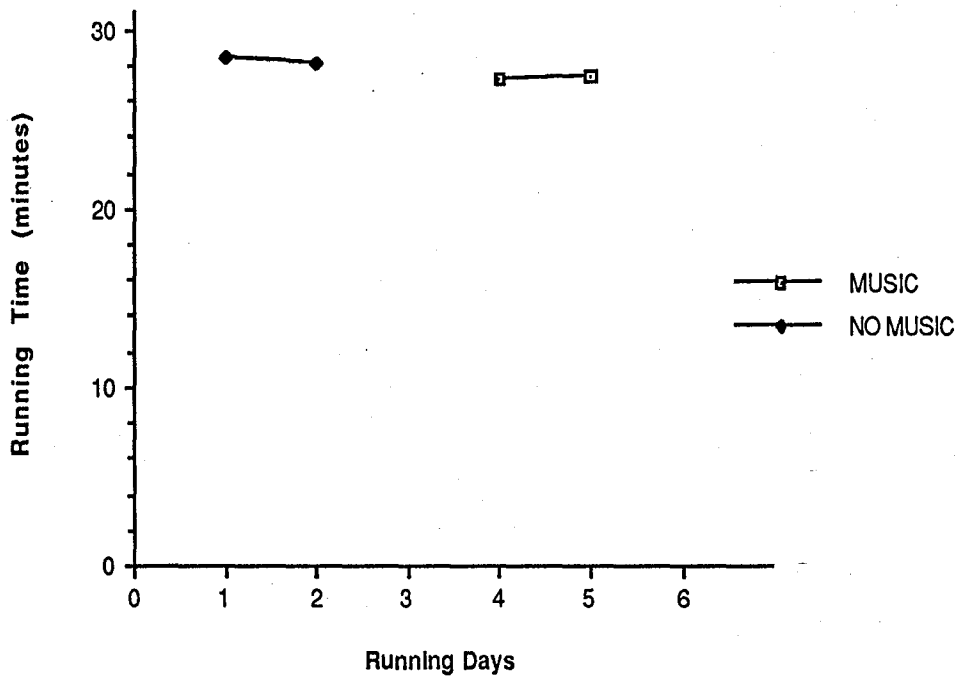

Figure 8. Participant 5's running times with and without music.

Participant 18 ran 16.3 min, 15.3 min, and 18 min for the music sessions vs. 26 min, 23.6 min, and 17.3 min for the no-music sessions (see Figure 9).

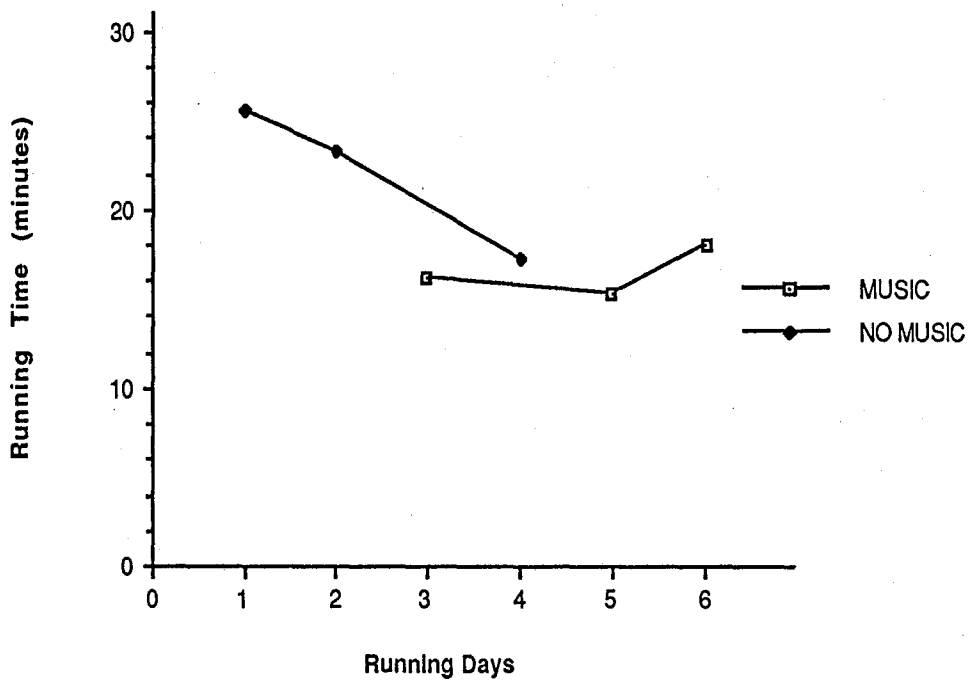

Figure 9. Participant 18's running times with and without music.

Similar running time with and without music. One participant (Participant I) reached the maximum running time of 30 min for all three running sessions without music vs. running times of 30 min, 29.7 min, and 29.3 min for the music sessions (see Figure 10).

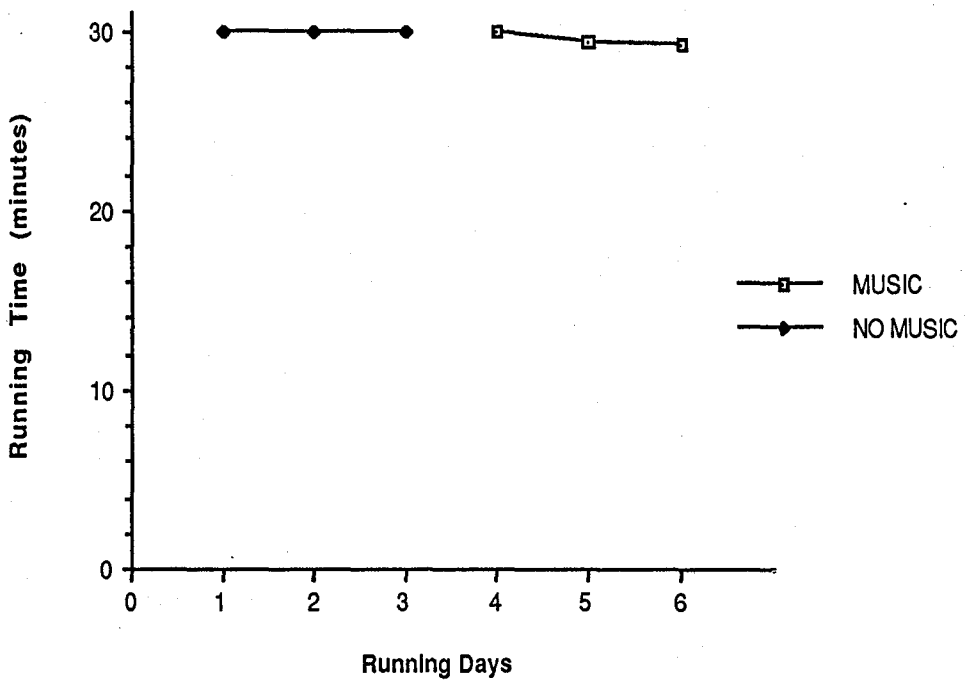

Figure 10. Participant 1's running times with and without music.

Another participant (Participant 11) produced running times that were the same for both running conditions, the maximum 30 min (see Figure 11).

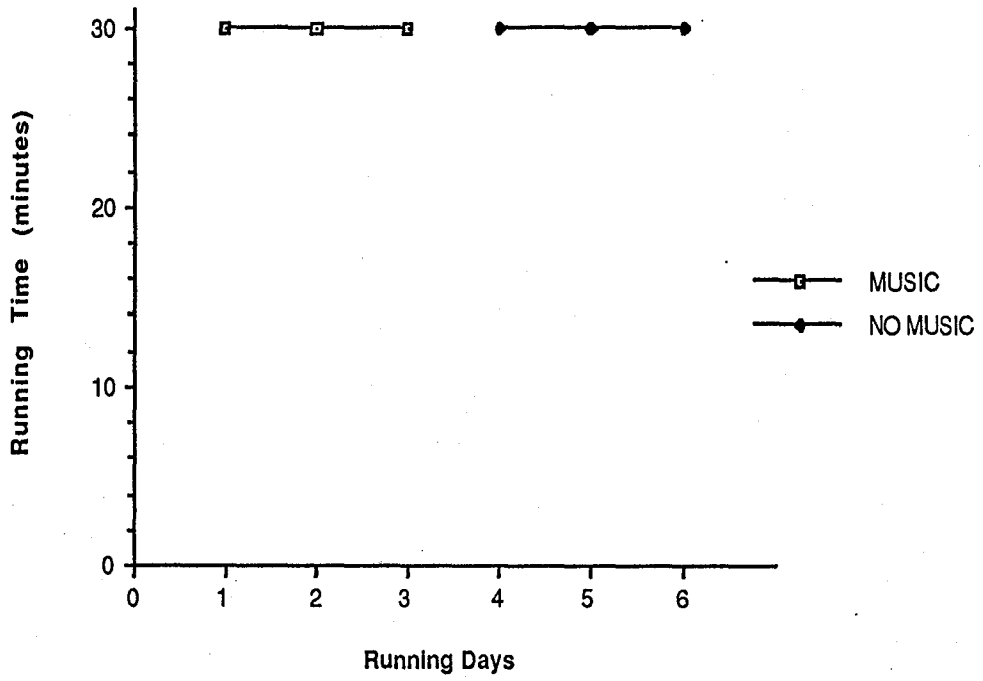

Figure 11. Participant 11's running times with and without music.

Still another participant (Participant 9) ran longer or stayed at the same maximum duration when comparing the two conditions; 30 min for all 3 music sessions vs. running 29.7 min, 26.4 min, and 30 min for the no-music sessions (see Figure 12).

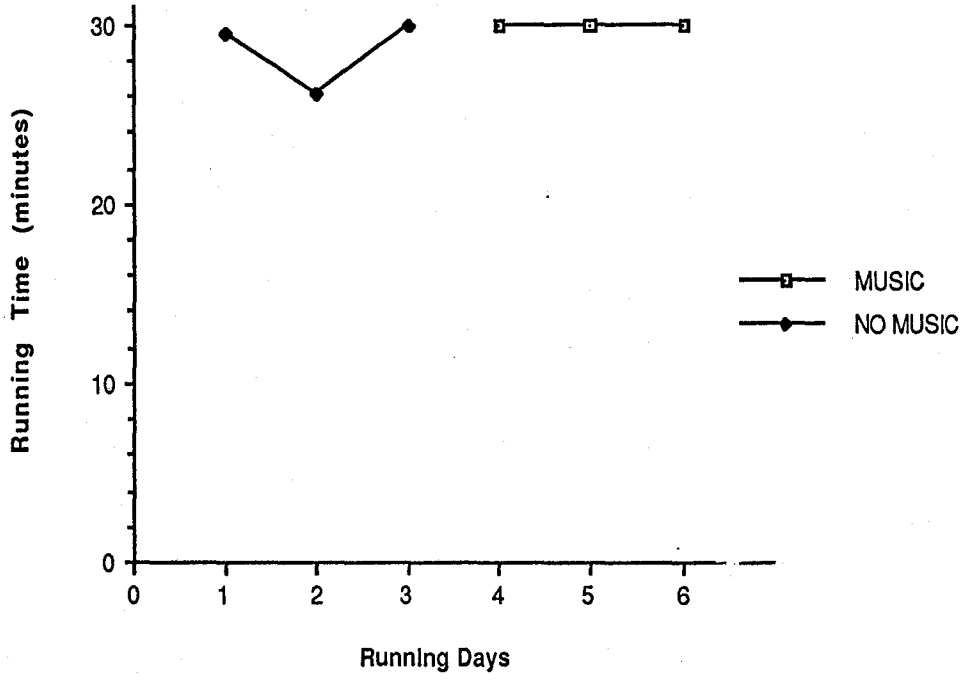

Figure 12. Participant 9's running times with and without music.

Inconsistent running time with music. Participants 4, 7, 8, 10, 12, and 17 showed running times that were inconsistent with each running condition. Participant 4's running times were 16.3 min, 30 min, and 29.7 min for the music sessions vs. 16.5 min, 30 min, and 22.8 min for the no-music sessions (see Figure 13).

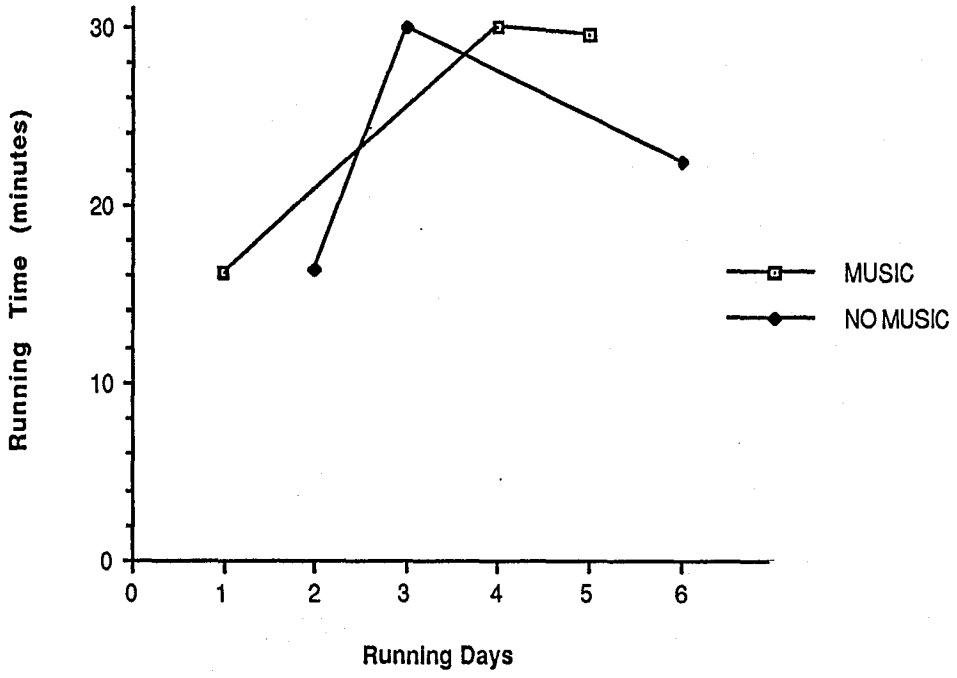

Figure 13. Participant 4's running times with and without music.

Participant 7 ran 28.8 min, 27.9 min, and 29.8 min for the music sessions vs. 20.7 min, 30 min, and one absence for the no-music sessions (see Figure 14).

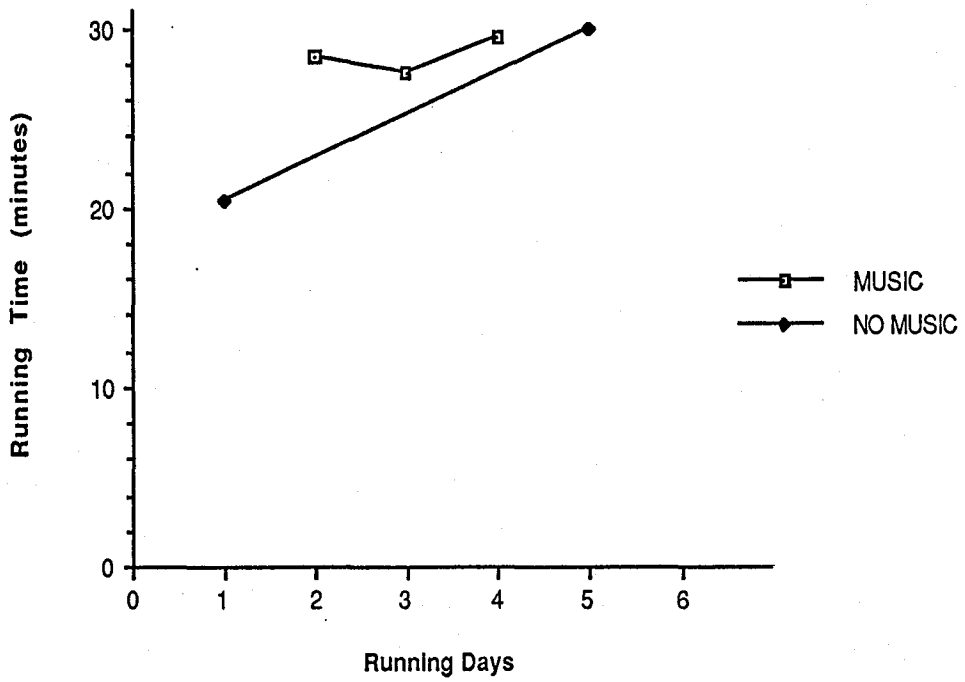

Figure 14. Participant 7's running times with and without music.

Participant 8 ran 27 min, 27.2 min, and 27.7 min with music vs. 28.6 min, 28.2 min, and 23.7 min without music (see Figure 15).

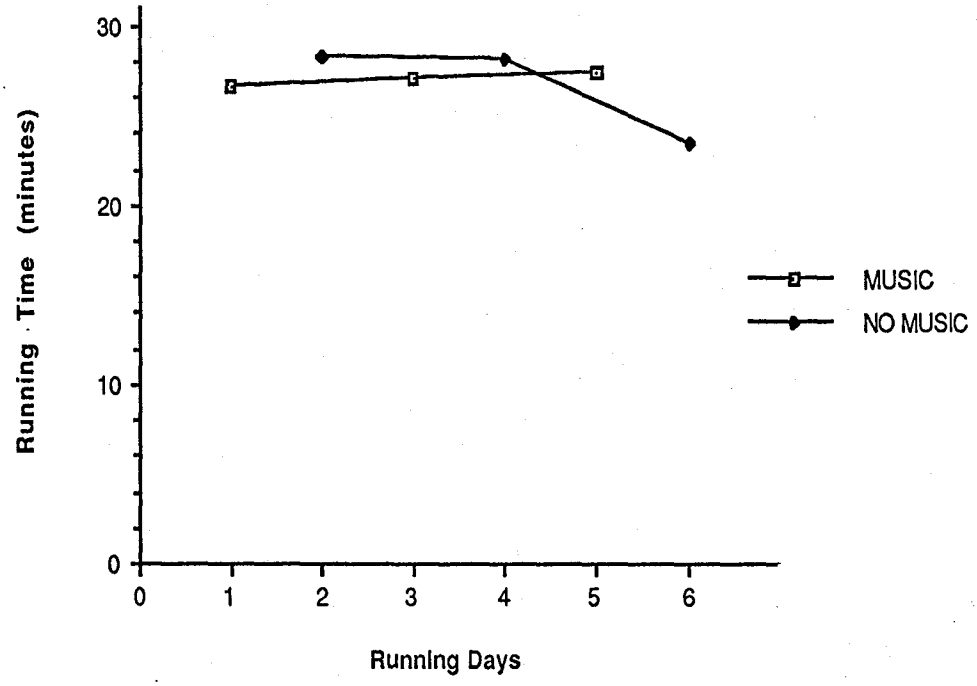

Figure 15. Participant 8's running times with and without music.

Participant 10's running times were 20.4 min and 20.3 min (with one absence) for the music sessions compared to 22.9 min and 19.1 min (with one absence) for the no music sessions (see Figure 16).

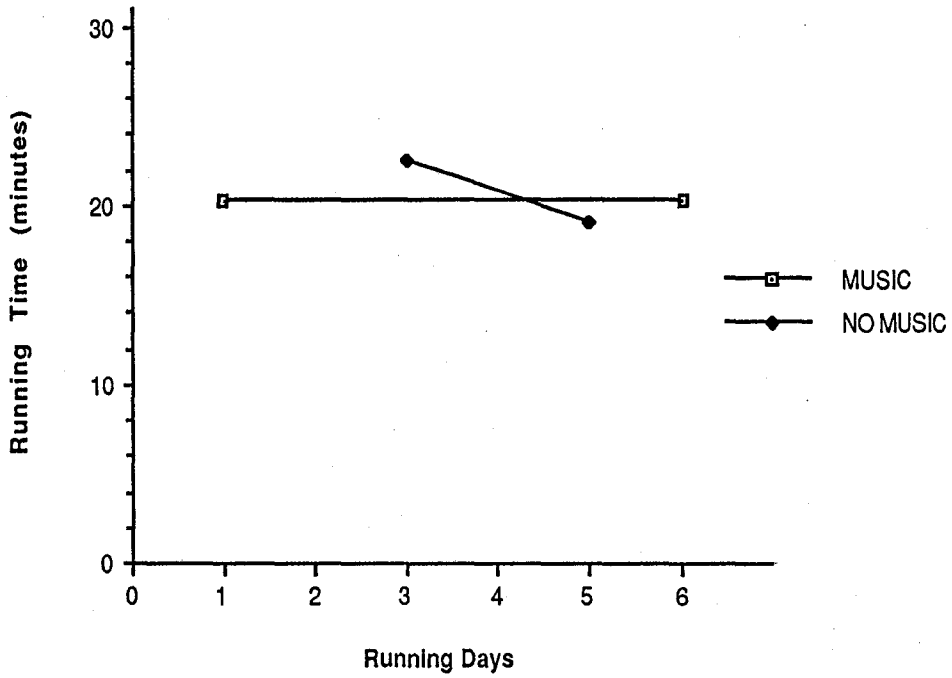

Figure 16. Participant 10's running times with and without music.

Participant 12 ran 24.3 min, 26.3 min, and 26.2 min with music vs. 26.3 min and 23.3 min (with one absence) without music (see Figure 17).

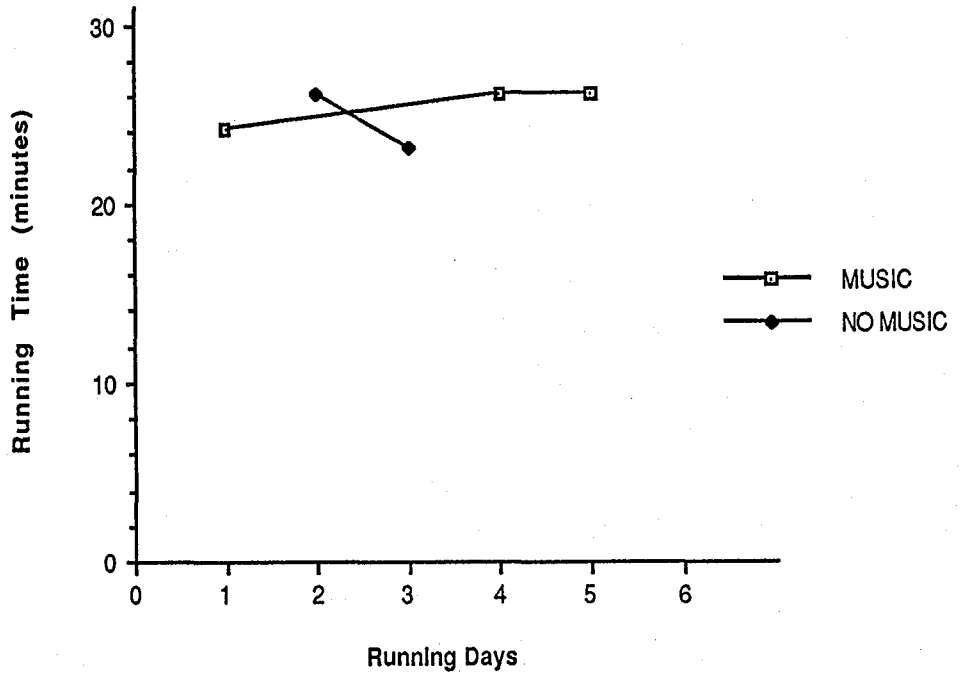

Figure 17. Participant 12's running times with and without music.

Participant 17 ran 21.1 min, 16.8 min, and 16 min for the music sessions and 17.6 min, 15 min, and 17.4 min for the no-music sessions (see Figure 18).

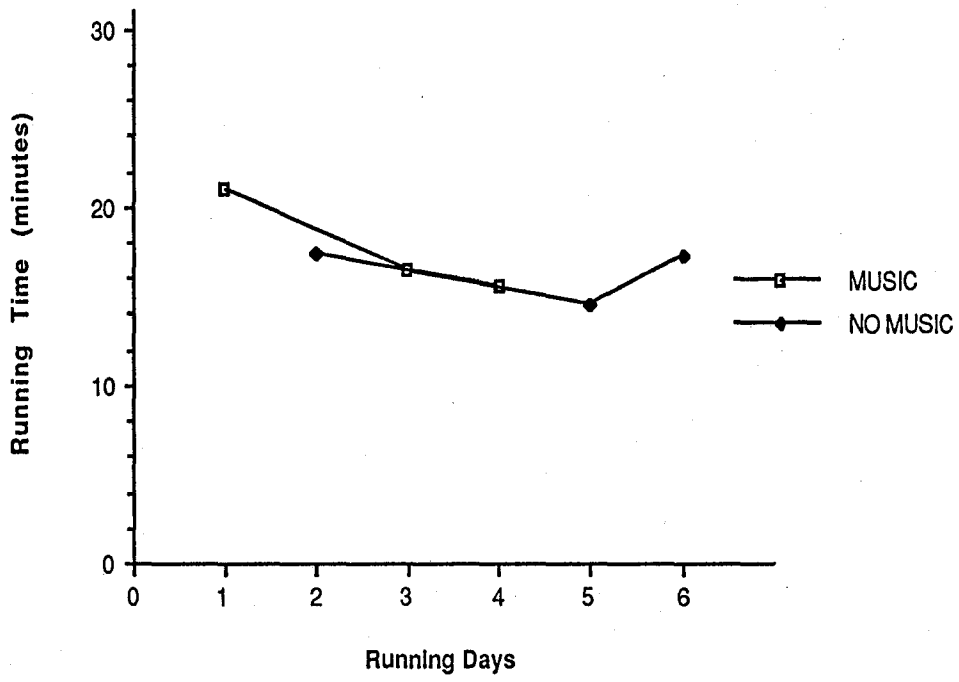

Figure 18. Participant 17's running times with and without music.

Perceived Enjoyment

Consistent increases in rated enjoyment with music. Participants 6, 8, 10, 11, 12, 13, 14, 15, and 16 all showed a consistent increase in perceived enjoyment questionnaire scores when running with music compared to running without music. Participant 6 gave ratings of 106 pts., 118 pts., and 79 pts. for the music sessions vs. 89 pts. and 79 pts. (with one absence) for the no-music sessions (see Figure 19).

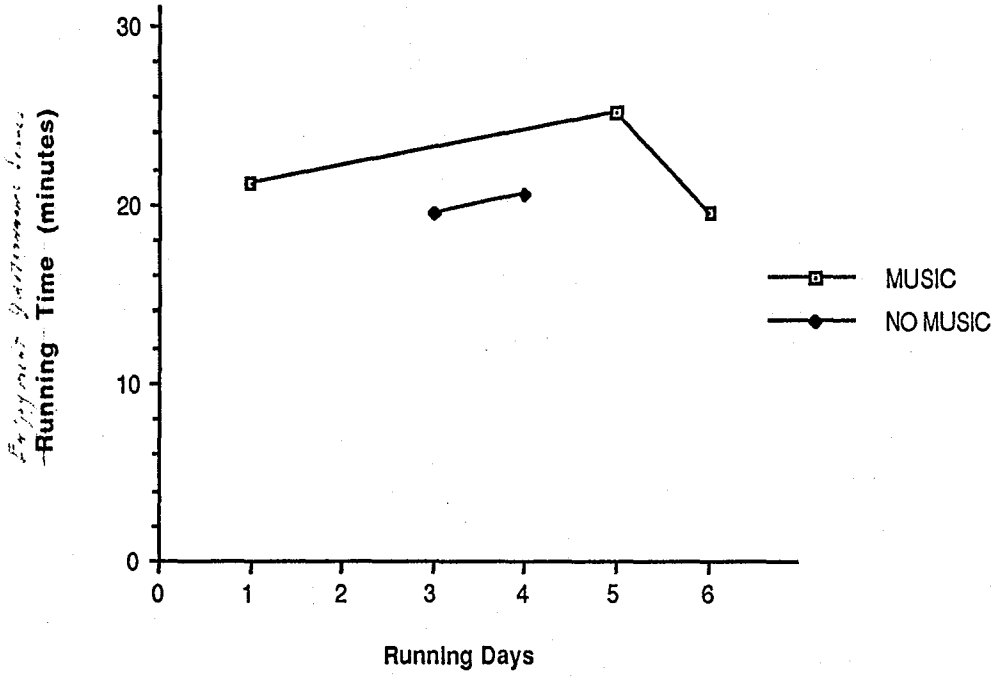

Figure 19. Participant 6's enjoyment questionnaire scores with and without music.

Perceived Enjoyment

Consistent increases in rated enjoyment with music. Participants 6, 8, 10, 11, 12, 13, 14, 15, and 16 all showed a consistent increase in perceived enjoyment questionnaire scores when running with music compared to running without music. Participant 6 gave ratings of 106 pts., 118 pts., and 79 pts. for the music sessions vs. 89 pts. and 79 pts. (with one absence) for the no-music sessions (see Figure 19).

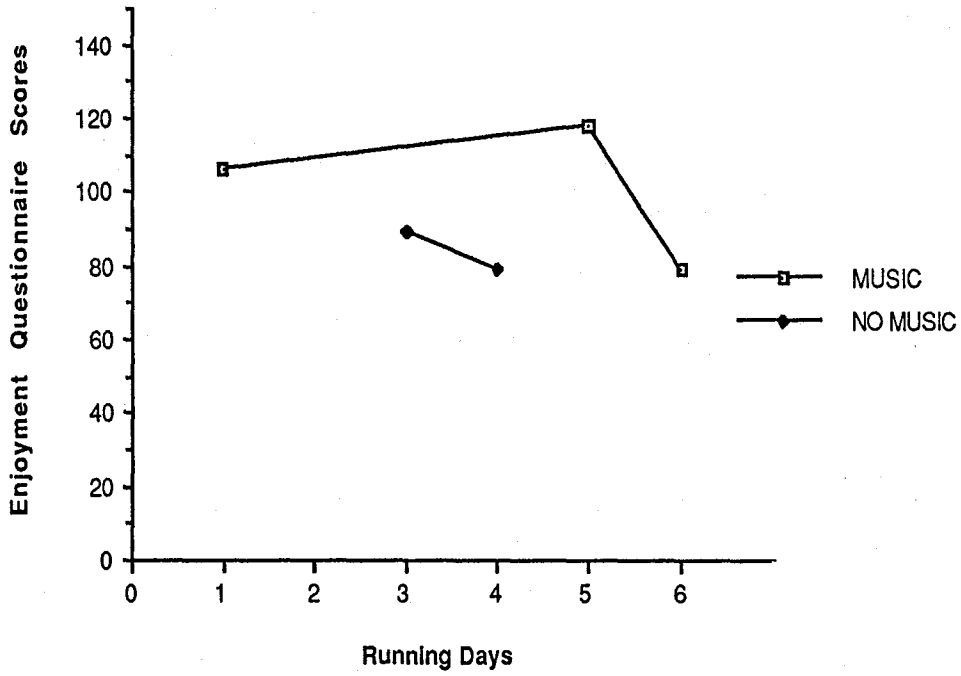

Figure 19. Participant 6's enjoyment questionnaire scores with and without music.

Participant 8 rated running enjoyment at 129 pts.,121 pts., and 121 pts. for the music sessions compared to 53 pts., 55 pts., and 26 pts. for the no-music sessions (see Figure 20).

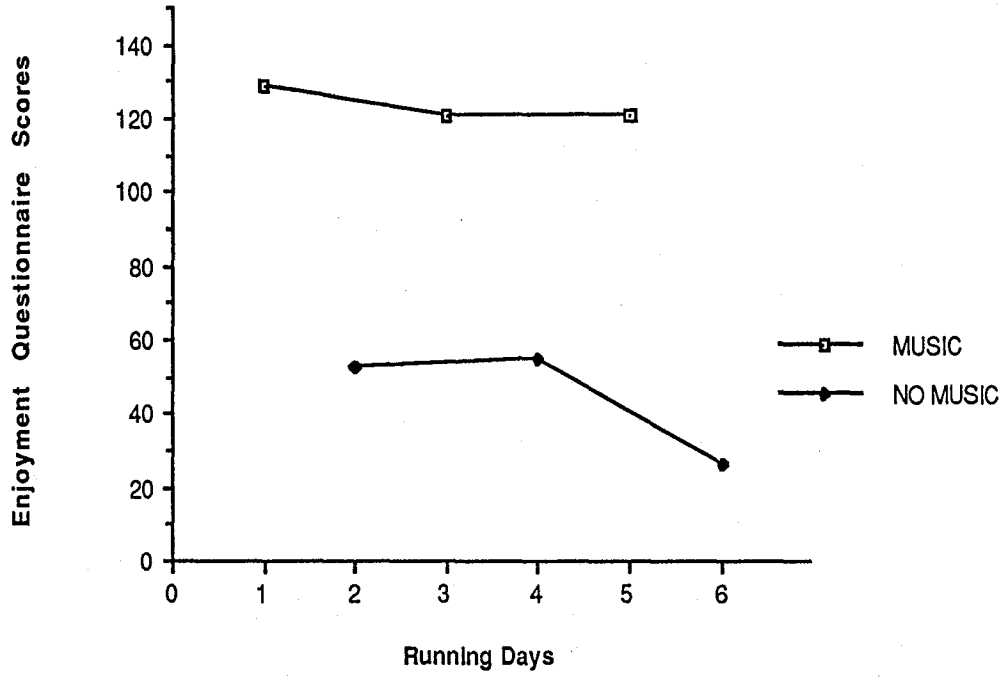

Figure 20. Participant 8's enjoyment questionnaire scores with and without music.

Participant 10's ratings were 86 pts. and 106 pts. (with one absence) for the music sessions vs. 87 pts. and 58 pts. (with one absence) for the no-music sessions (see Figure 21).

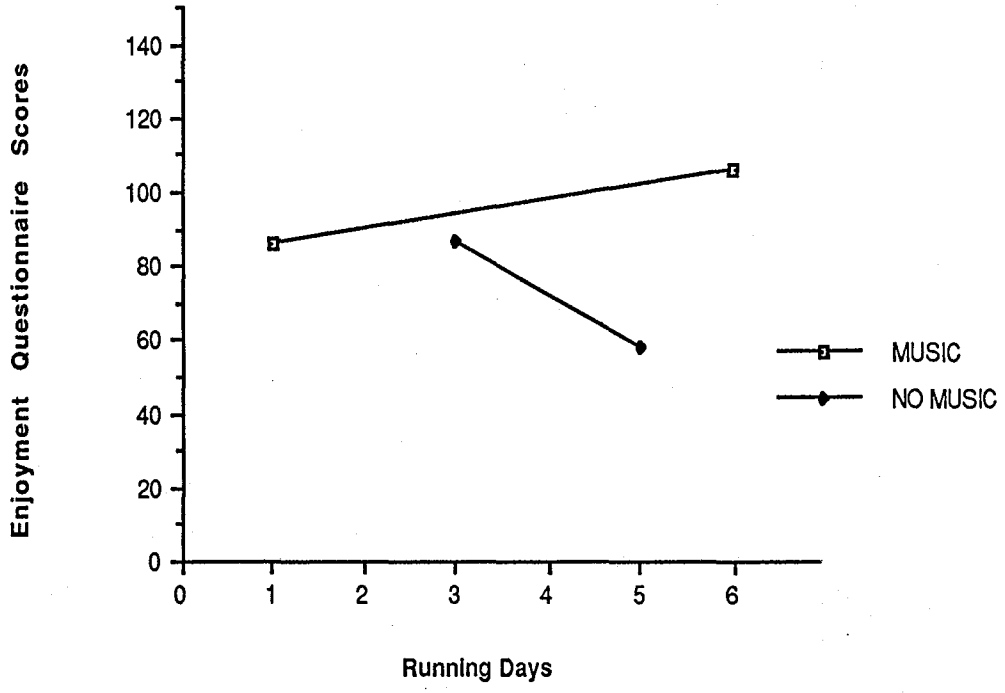

Figure 21. Participant 10's enjoyment questionnaire scores with and without music.

Participant 11 gave ratings of 118 pts., 111 pts., and 122 pts. for the music sessions vs. 106 pts., 106 pts., and 127 pts. for the no-music sessions (see Figure 22).

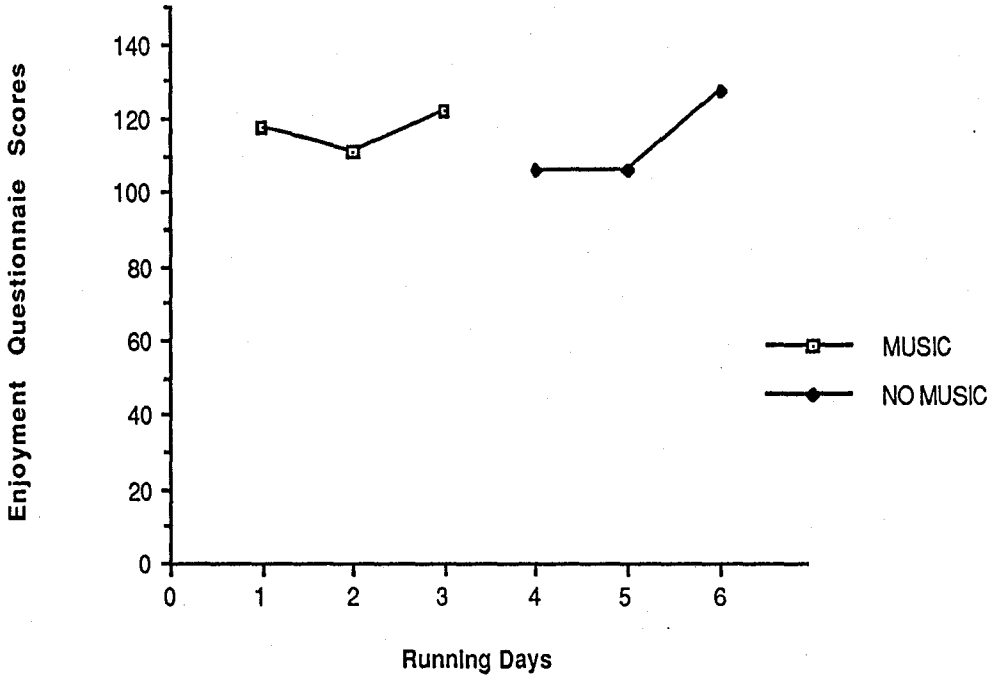

Figure 22. Participant 11's enjoyment questionnaire scores with and without music.

Participant 12's ratings were 88 pts., 87 pts., and 104 pts. for the music sessions vs. 74 pts. and 58 pts. (with one absence) for the no-music sessions (see Figure 23).

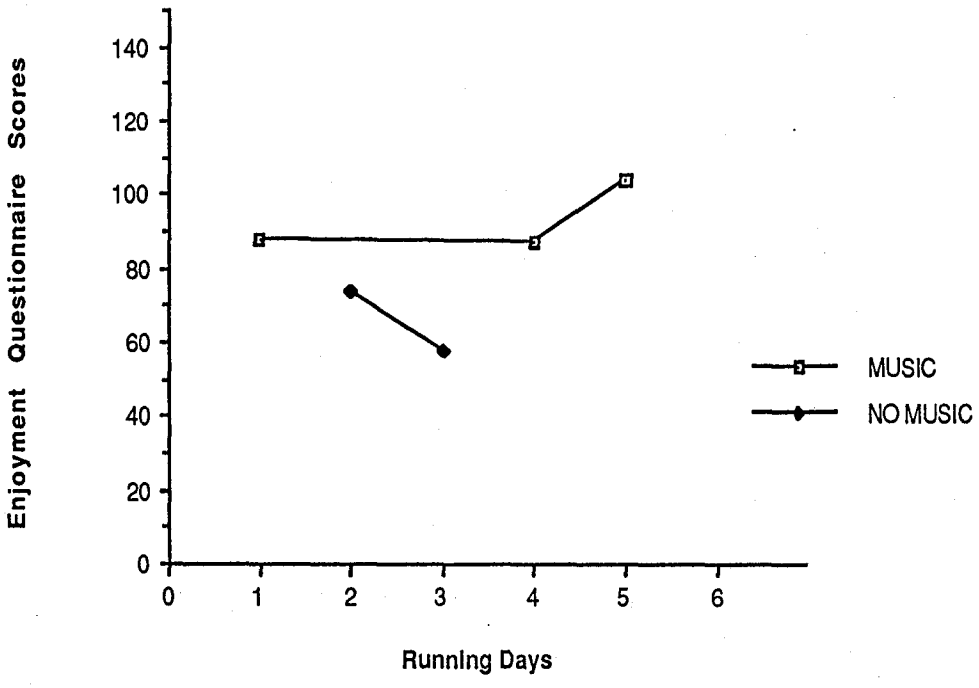

Figure 23. Participant 12's enjoyment scores with and without music.

Participant 13 rated running at 115 pts. and 119 pts. (with one absence) for the music sessions vs. 107 pts., 98 pts., and 111 pts. for the no-music sessions (see Figure 24).

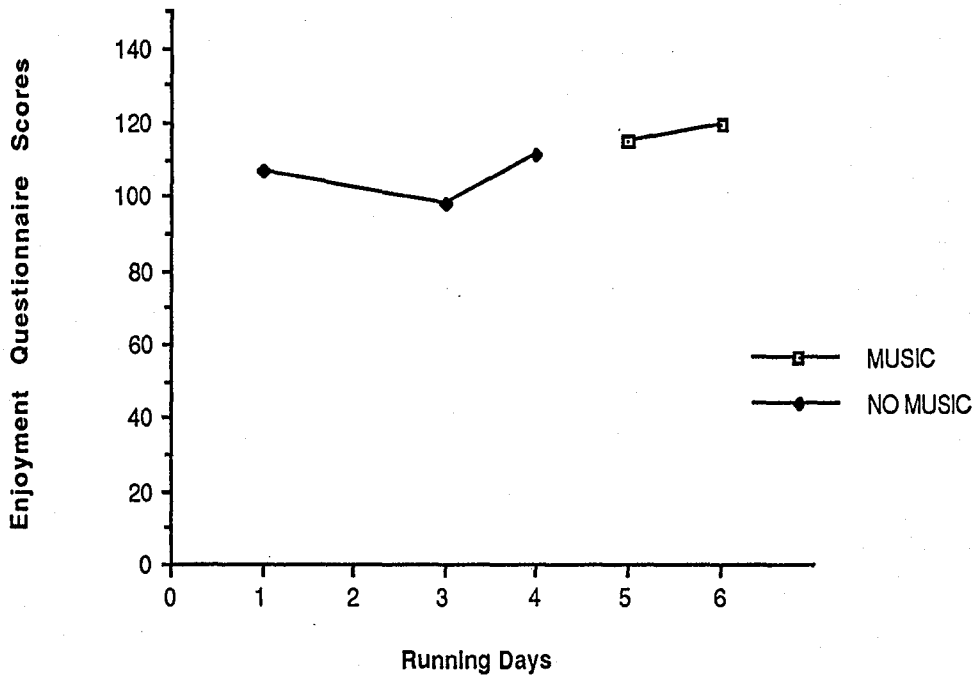

Figure 24. Participant 13's enjoyment questionnaire scores with and without music.

Participant 14's ratings were 57 pts., 57 pts., and 64 pts. for the music sessions vs. 17 pts., 30 pts., and 39 pts. for the no-music sessions (see Figure 25).

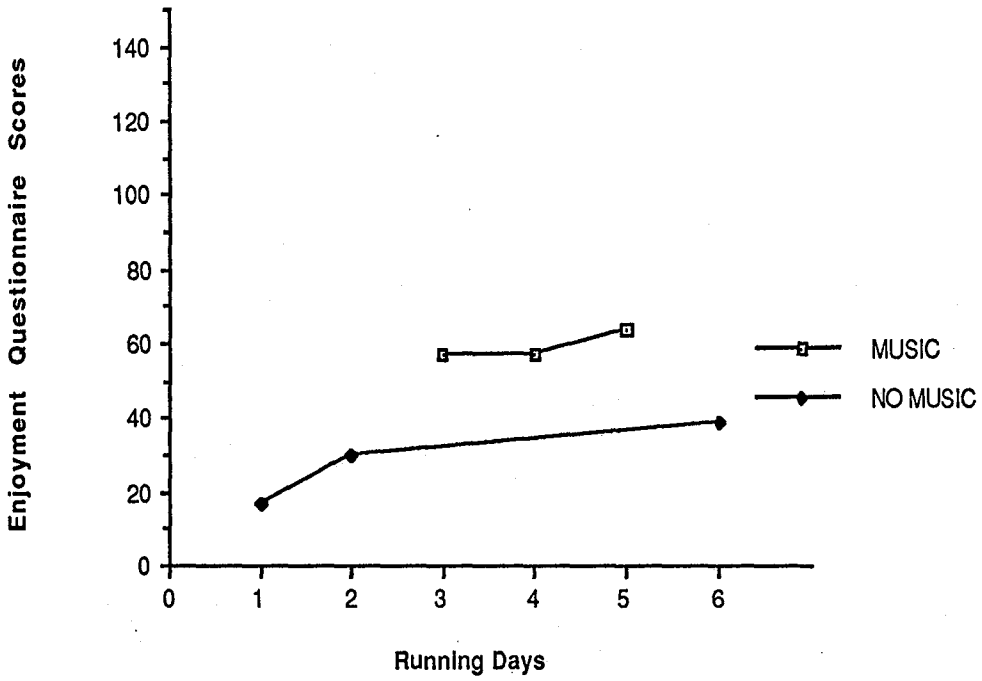

Figure 25. Participant 14's enjoyment questionnaire scores with and without music.

Participant 15 gave ratings of 67 pts., 90 pts., and 73 pts. for the music sessions compared to 60 pts. and 49 pts. (with one absence) for the no-music sessions (see Figure 26).

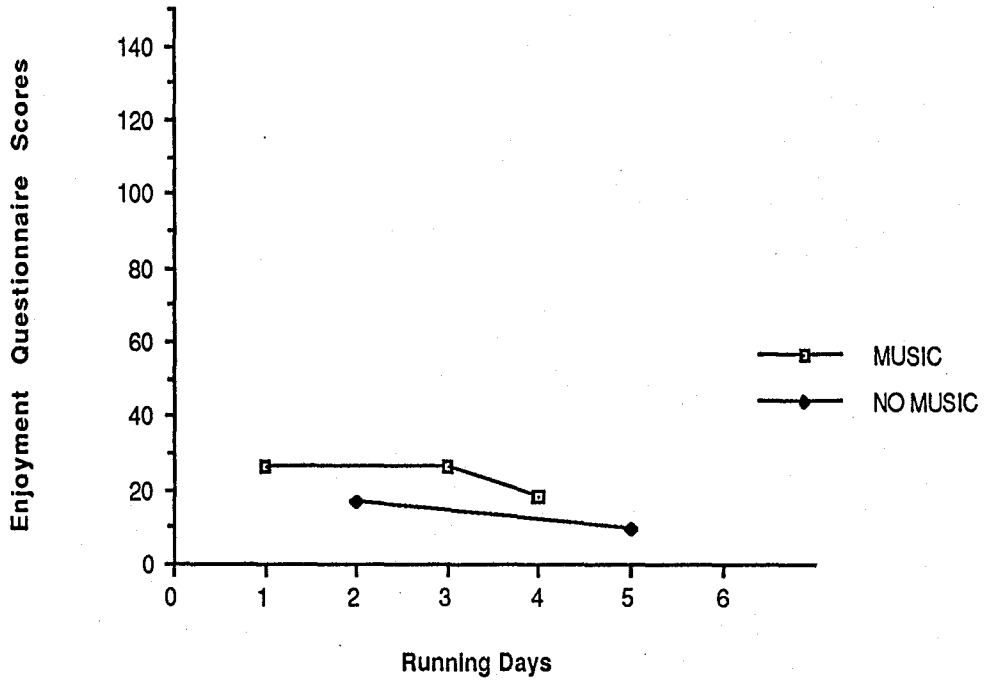

Figure 26. Participant 15's enjoyment questionnaire scores with and without music.

Participant 16 indicated consistently higher enjoyment for the music sessions with 92 pts., 75 pts., and 79 pts. when compared to the scores for the no-music sessions of 61 pts. and 61 pts. (with one absence) (see Figure 27).

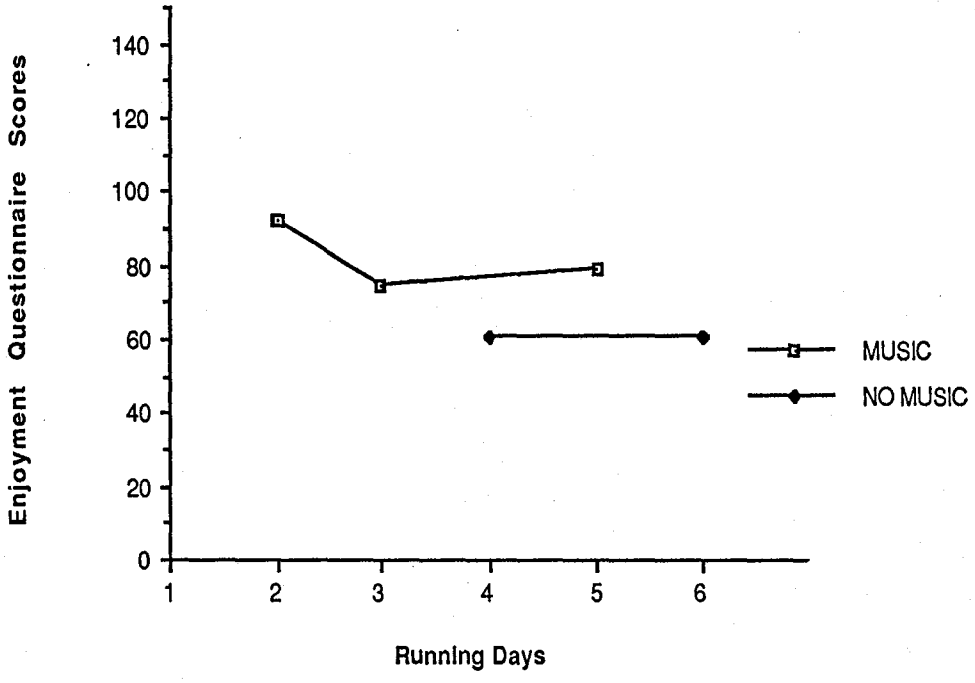

Figure 27. Participant 16's enjoyment questionnaire scores with and without music.

One participant (Participant I) gave higher or the same questionnaire scores while using music when running: 115 pts., 124 pts., and 116 pts. vs. 100 pts., 115 pts., and 99 pts. when running without music (see Figure 28).

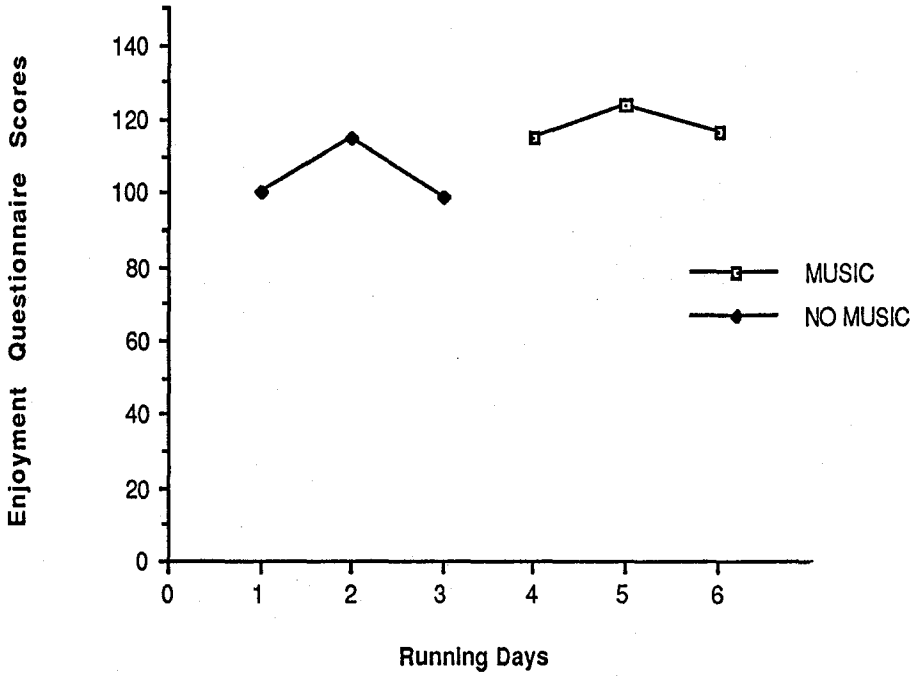

Figure 28. Participant 1's enjoyment questionnaire scores with and without music.

Consistent decreases in rated enjoyment with music. Only one participant (Participant 5) showed a consistent decline in enjoyment questionnaire scores when using music while running, in comparison to running without music. The ratings were: 68 pts. and 61 pts. (with one absence) vs. 110 pts. and 93 pts. (with one absence) respectively (see Figure 29).

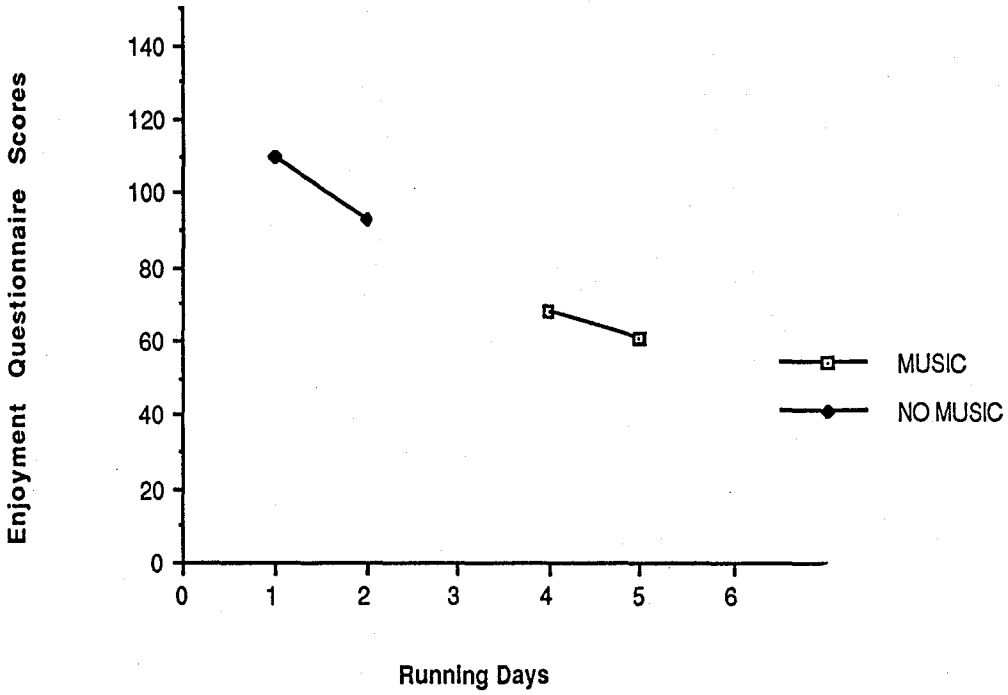

Figure 29. Participant 5's enjoyment questionnaire scores with and without music.

Inconsistent enjoyment ratings. The remaining participants, Participant 2, 3, 4, 7, 9, 17, and 18 gave inconsistent ratings on the questionnaire in reference to the music conditions. Participant 2's ratings were: 140 pts., 94 pts., and 127 pts. for the music sessions vs. 114 pts. (with two absences) for the no-music sessions (see Figure 30).

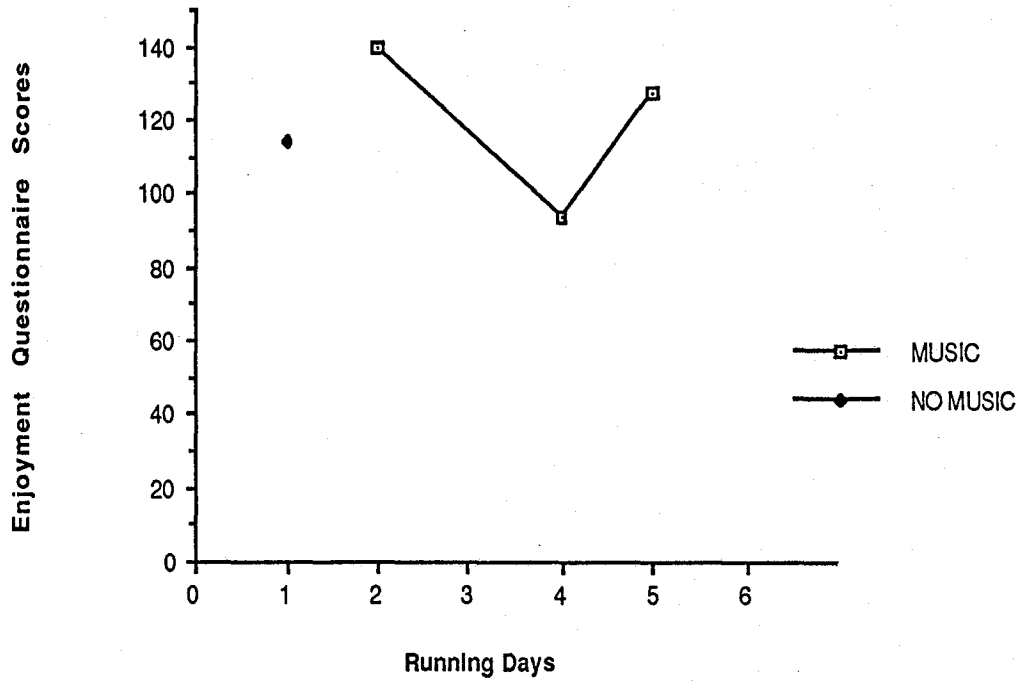

Figure 30. Participant 2's enjoyment questionnaire scores with and without music.

Participant 3's ratings were 89 pts. and 62 pts. (with one absence) for the music sessions vs. 85 pts., 86 pts., and 108 pts. for the no-music sessions (see Figure 31).

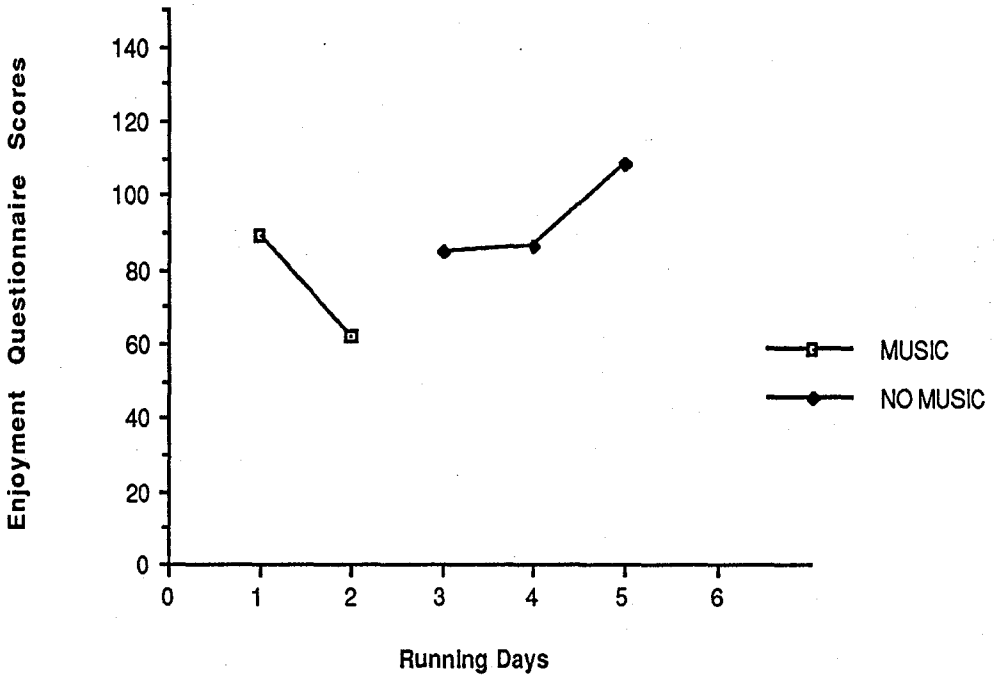

Figure 31. Participant 3's enjoyment questionnaire scores with and without music.

Participant 4 gave ratings of 87 pts., 96 pts., and 64 pts. for the music sessions compared to 85 pts., 99 pts., and 61 pts. for the no-music sessions (see Figure 32).

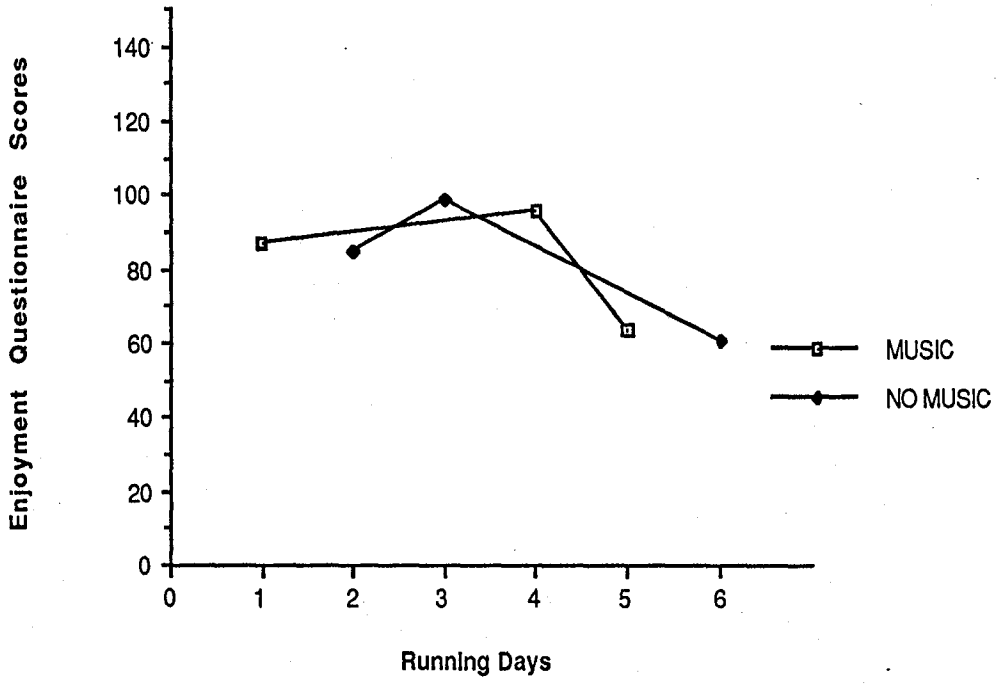

Figure 32. Participant 4's enjoyment questionnaire scores with and without music.

Participant 7 gave ratings of 110 pts., 91 pts., and 97 pts. for the music sessions vs. 58 pts. and 106 pts. (with one absence) for the no-music sessions (see Figure 33).

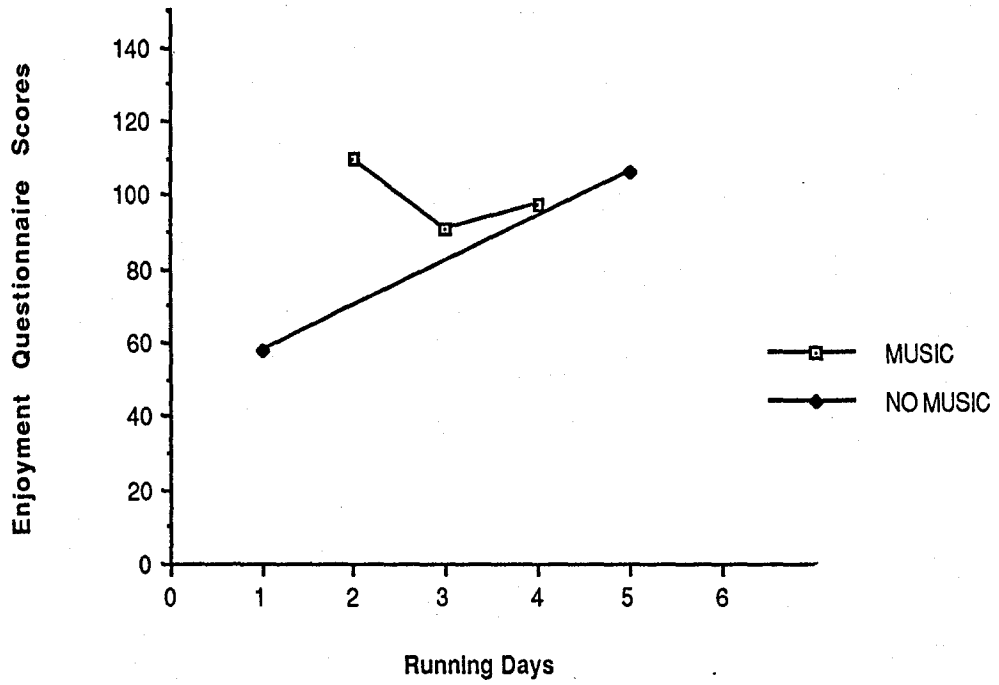

Figure 33. Participant 7's enjoyment questionnaire scores with and without music.

Participant 9's ratings were: 74 pts., 96 pts., and 119 pts. for the music sessions vs. 77 pts., 87 pts., and 92 pts. for the no-music sessions (see Figure 34).

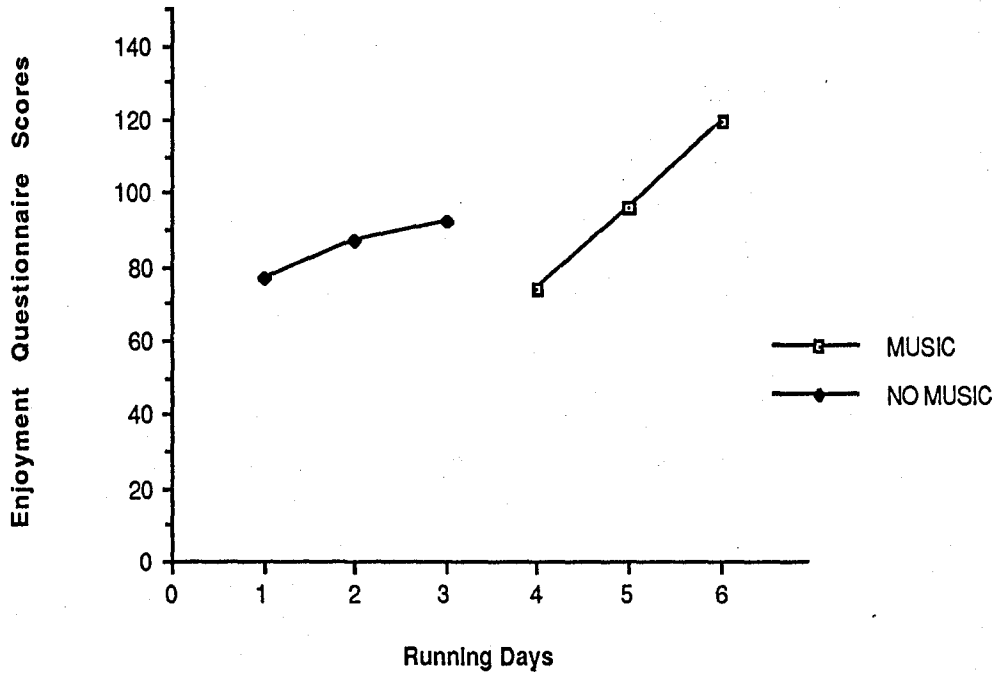

Figure 34. Participant 9's enjoyment questionnaire scores with and without music.

Participant 17 gave ratings of 99 pts., 93 pts., and 96 pts. for the music sessions vs. 96 pts., 83 pts., and 95 pts. for the no-music sessions (see Figure 35).

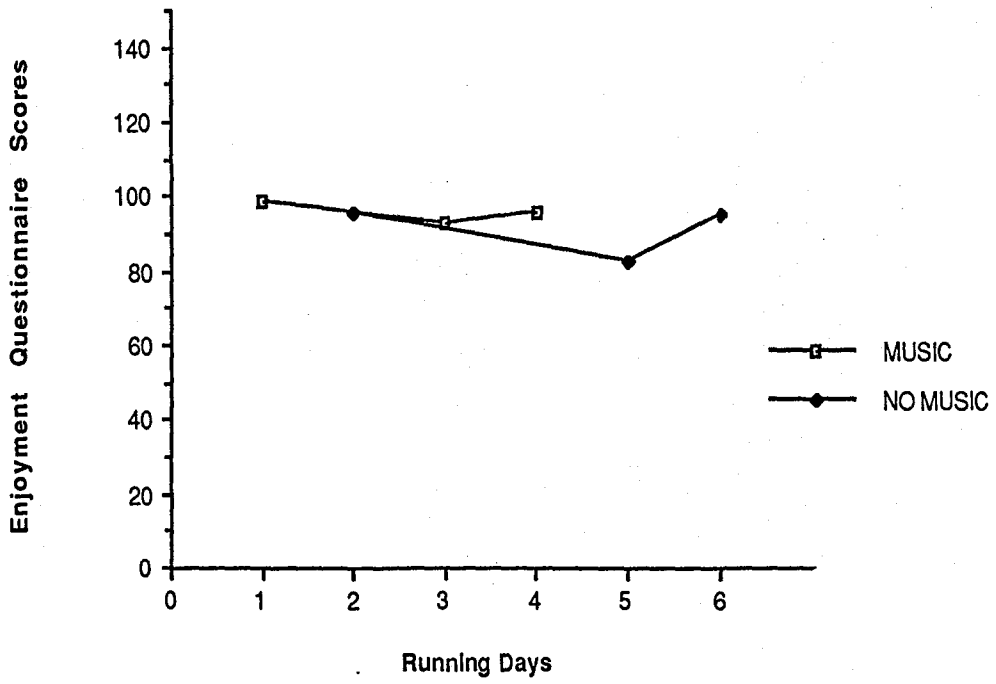

Figure 35. Participant 17's enjoyment questionnaire scores with and without music.

Participant 18 gave inconsistent ratings of 93 pts., 105 pts., and 116 pts. for the music sessions vs. 103 pts., 92 pts., and 101 pts. for the no-music sessions (see Figure 36).

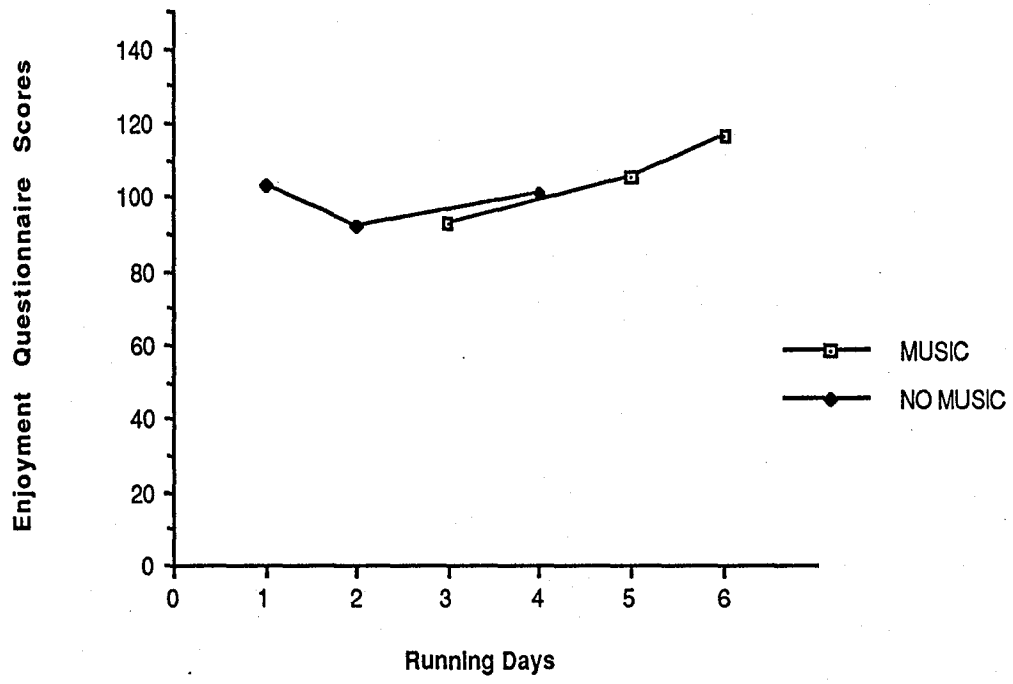

Figure 36. Participant 19's enjoyment questionnaire scores with and without music.

Overall/Group Performance

Overall Rated Enjoyment Scores

The presence of music during the running sessions proved to be an important factor in increasing perceived enjoyment questionnaire scores. Mean scores for the two conditions on the perceived enjoyment questionnaire were 94.6 pts. (out of a possible 150 points) for the music condition vs. 80.5 pts. for the no-music condition. Plotting overall rated enjoyment scores for both conditions by running days, revealed that music days were rated higher in enjoyment than

no-music days for all running sessions but one. This session displayed similar ratings of enjoyment for both conditions (see Figure 37).

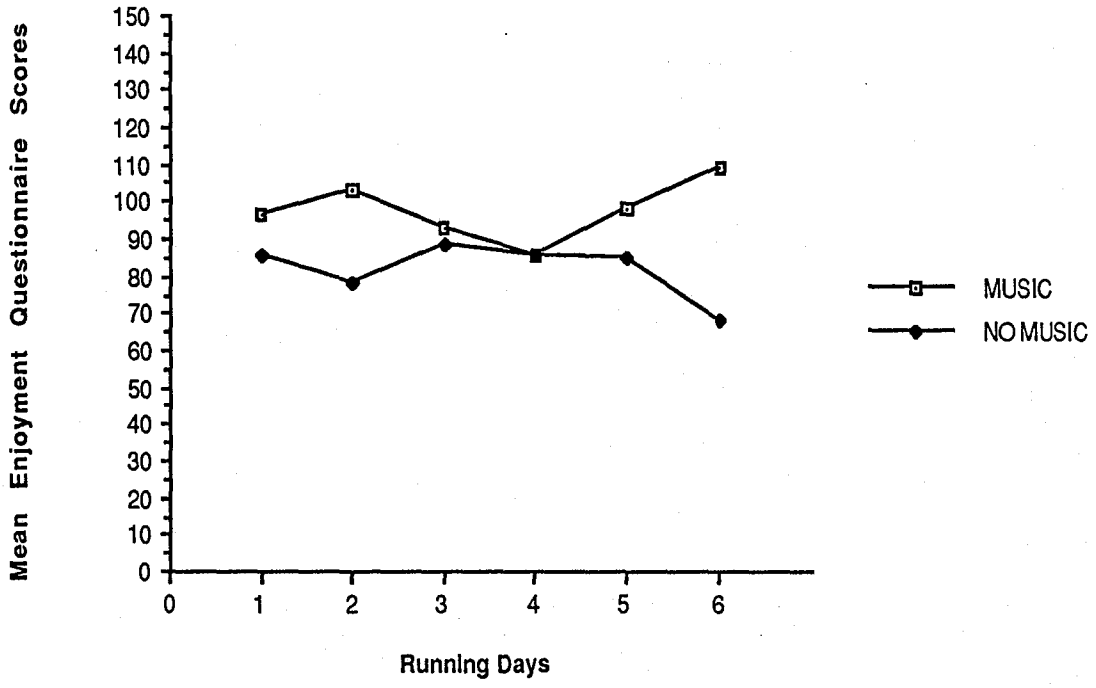

Figure 37. Participants' rated enjoyment scores for both conditions on each running day.

Group Rated Enjoyment Scores

11:00 and 12:00 group scores. The 11:00 group mean scores on the enjoyment questionnaire were 99.5 pts. for the music condition vs. 88.8 pts. for the no-music condition. The 12:00 group mean scores on the enjoyment questionnaire were 89.8 pts. for music condition and 72.2 pts. for no-music condition (see Figure 38).

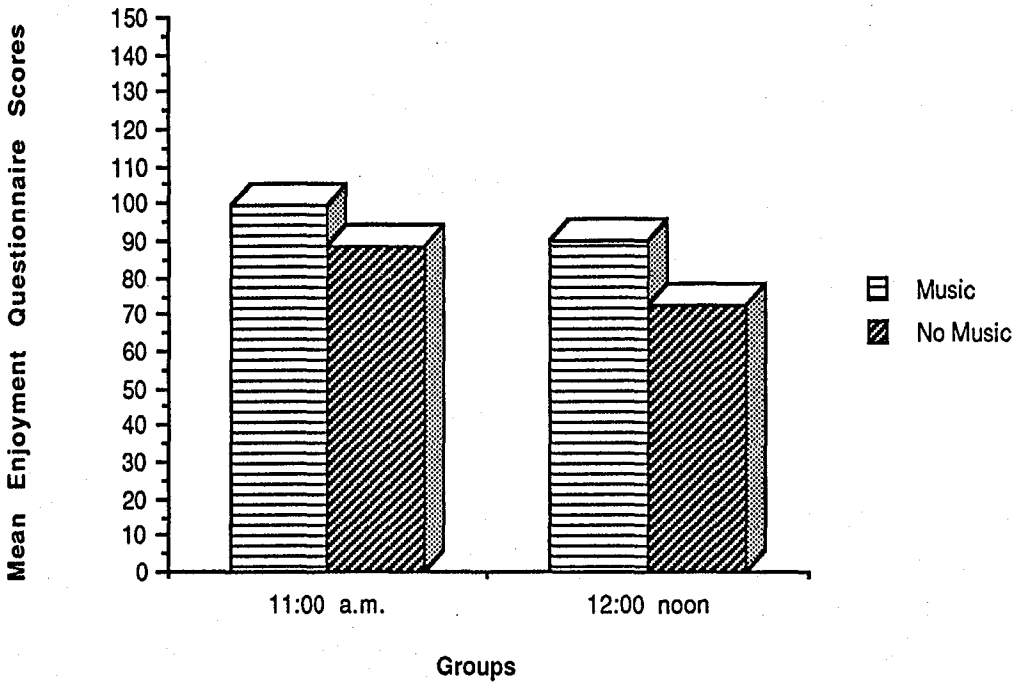

Figure 38. Rated running enjoyment with and without music for both groups.

The 11:00 and 12:00 groups' mean scores were 94.1 pts. and 81 pts. respectively on the questionnaire.

11:00 group scores. Plotting the 11:00 group's rated enjoyment scores for both conditions by running days, revealed that running with music was rated more enjoyable than running without music on all six of the running sessions (see Figure 39).

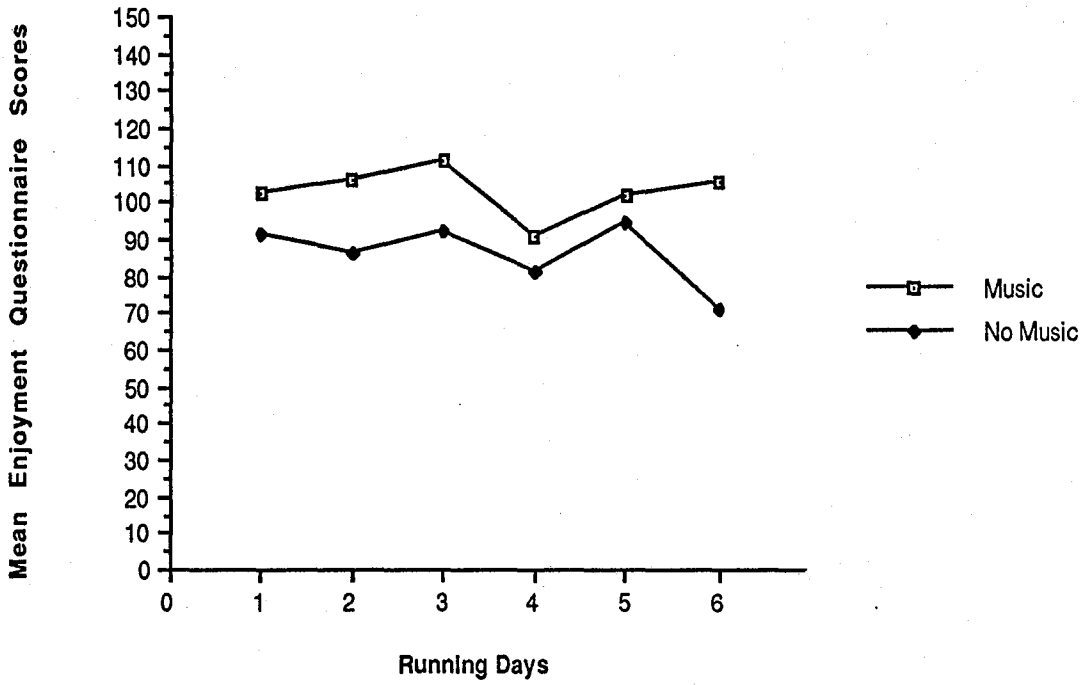

Figure 39. 11:00 group's rated enjoyment scores for both conditions on each running day.

12:00 group scores. Plotting the 12:00 group's enjoyment scores for both music conditions on each running day, resulted in higher enjoyment ratings for running with music than without music on 5 out of the 6 running sessions (see Figure 40).

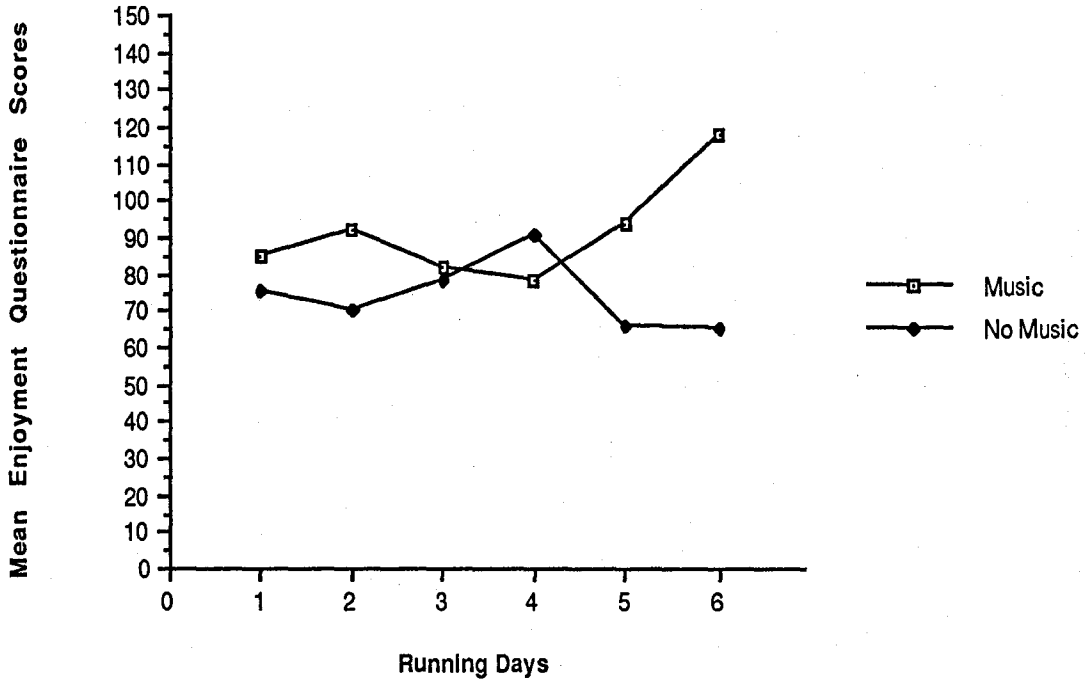

Figure 40. 12:00 group's rated enjoyment scores for both conditions on each running day.

ANOVA for Rated Enjoyment Scores

SPF- 2.2 ANOVA confirmed the hypothesis that the presence of music while running would increase a person's perceived enjoyment of the running activity. It also revealed no significant group (11:00 vs. 12:00) differences or interaction effect (see Table 1 for the summary of ANOVA).

Table 1

Summary of ANOVA for Rated Enjoyment Dependent Measure

Source	SS	df	MS	F	p
1. Group Time	1469.8	1	1469.8	2.33	.14
2. Subjects within groups	10109.7	16	631.8		
3. Music Condition	1714.8	1	1714.8	6.25	.02
4. Music X Group	101.4	1	101.4	___	.56
5. Music X Subjects within groups	4391.6	16	274.5		

Overall Running Times

The second hypothesis, that a significant increase in running duration could be attributed to the presence of music, was not revealed. The mean running duration of the music condition was 23.9 min (out of a possible 30 minutes) vs. 22.1 min for the no-music condition. Plotting overall running times for both conditions by running days revealed inconsistent differences in running times between the two conditions (see Figure 41).

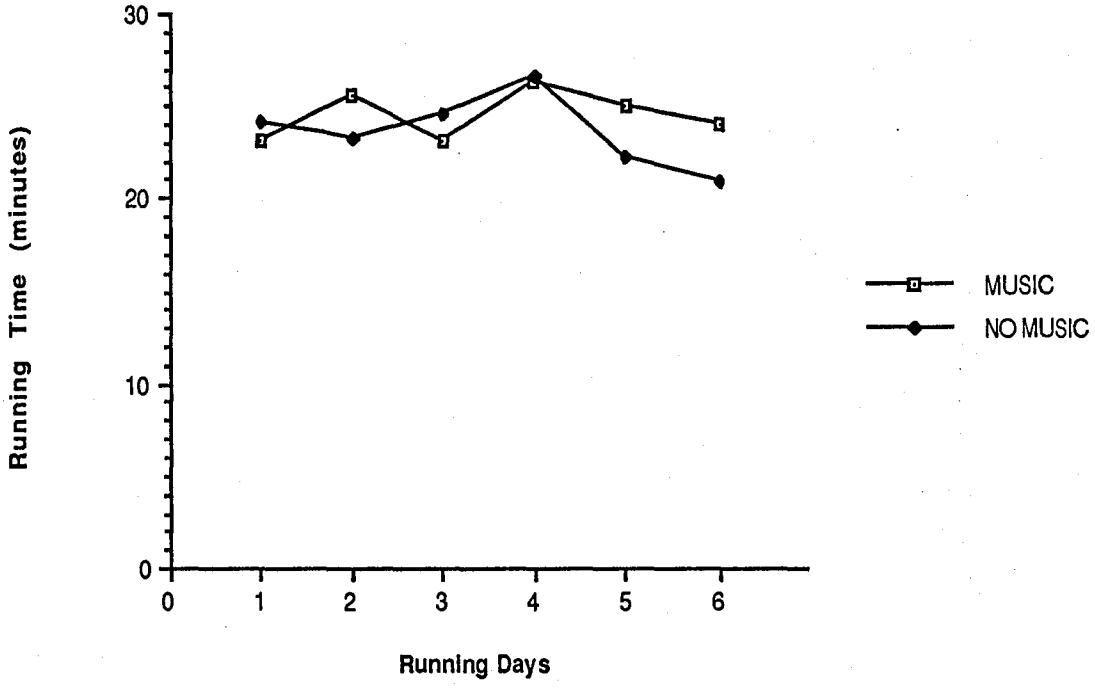

Figure 41. Participants' running times for both conditions on each running day.

Group Running Times

11:00 and 12:00 group scores. Mean running times for the 11:00 group were 26.5 min with music vs. 26.3 min without music, and 21.2 min with music vs. 17.9 min without music for the 12:00 group (see Figure 42).

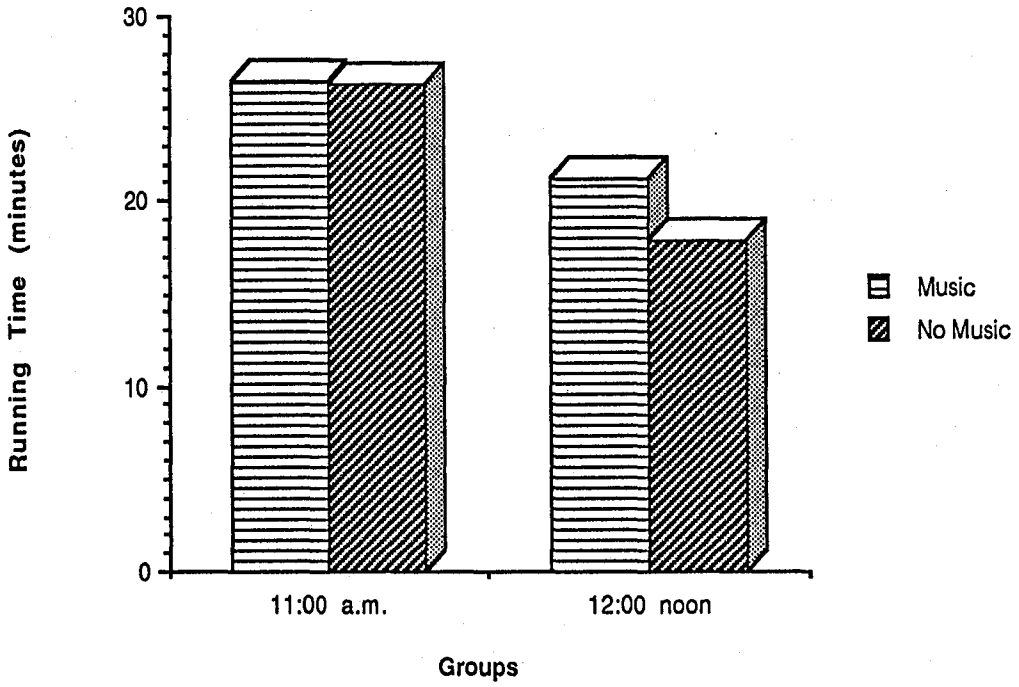

Figure 42. Running times with and without music for both groups.

Group differences were also noted with mean running durations of 26.4 min for the 11:00 group and 19.6 min for the 12:00 group.

11:00 group scores. Plotting the 11:00 group's running times for both conditions on each running day displayed increased running times with music compared to no-music in 4 of the 6 sessions (see Figure 43).

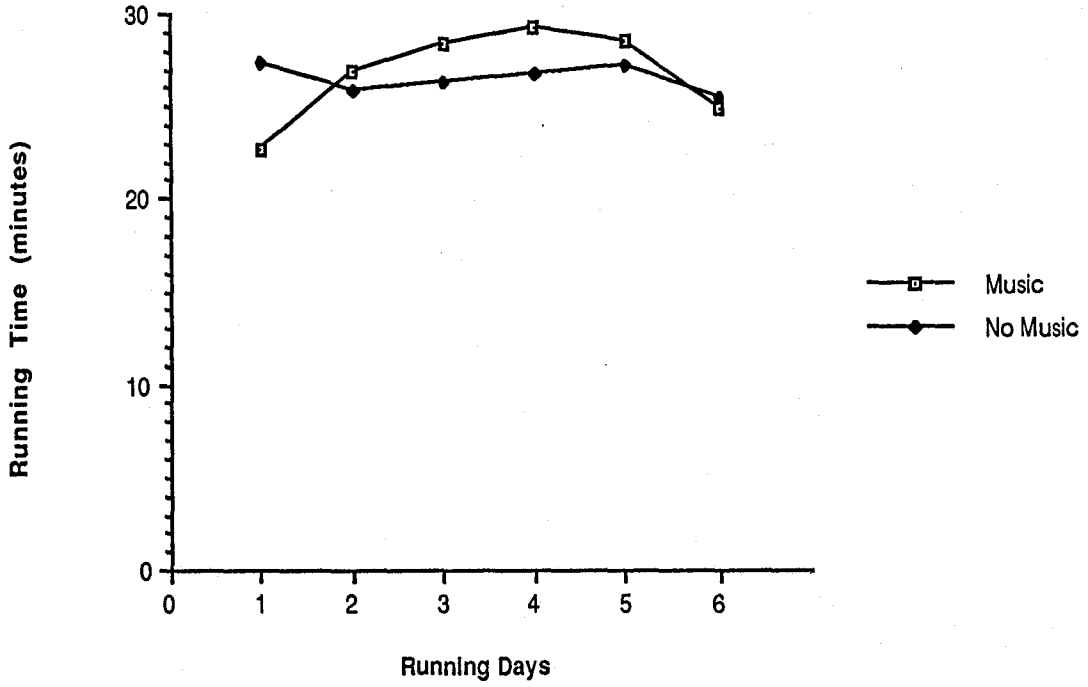

Figure 43. 11:00 group's running times for both conditions on each running day.

12:00 group scores. Plotting the 12:00 group's running times for both conditions on each running day, resulted in increased running times with music vs. without music in 5 out of the 6 sessions (see Figure 44).

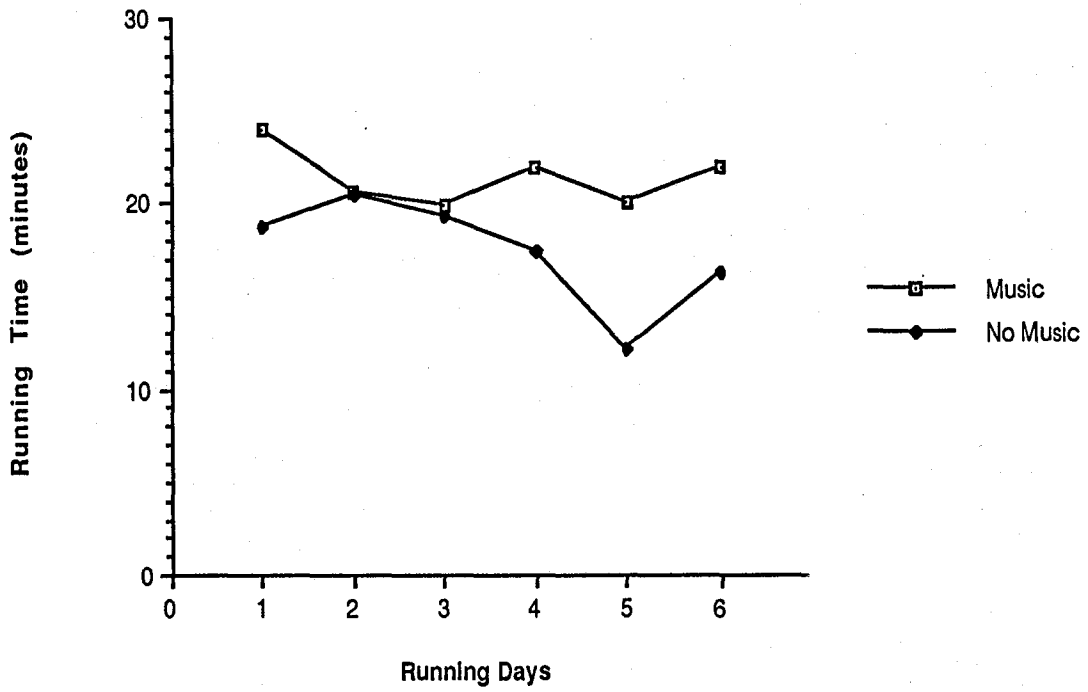

Figure 44. 12:00 group's running times for both conditions on each running day.

ANOVA for Running Times

The ANOVA also did not confirm the hypothesis that running with music would significantly increase one's running duration. There was a significant main effect between the two groups, with the 12:00 group running for shorter durations of time than the 11:00 group. In addition, no significant interaction effect of the two groups by running condition was demonstrated (see Table 2 for the summary of ANOVA).

Table 2

Summary of ANOVA for Running Time Dependent Measure

Source	SS	df	MS	F	p
1. Group Time	395.6	1	395.6	21.46	<.0005
2. Subjects within groups	294.9	16	18.4		
3. Music Condition	25.6	1	25.6	3.5	.08
4. Music X Group	21.6	1	21.6	2.97	.10
5. Music X Subjects within groups	116.7	16	7.3		

Overall Heart Rate Measures

A significant increase in heart rate due to the presence of music, the third hypothesis, was also not observed. Mean heart rate measures were 155.2 heart beats per minutes (HBM) for the music condition vs. 157.1 HBM for the no-music condition. Plotting overall heart rates by running days was not completed since heart rate measures remained the same throughout the study.

Group Heart Rate Measures

11:00 and 12:00 group measures. Mean heart rates for the 11:00 group were 154.9 HBM with music vs. 158.1 HBM without music. Mean heart rates for the 12:00 group were 155.6 HBM with music vs. 156.1 HBM without music (see Figure 45).

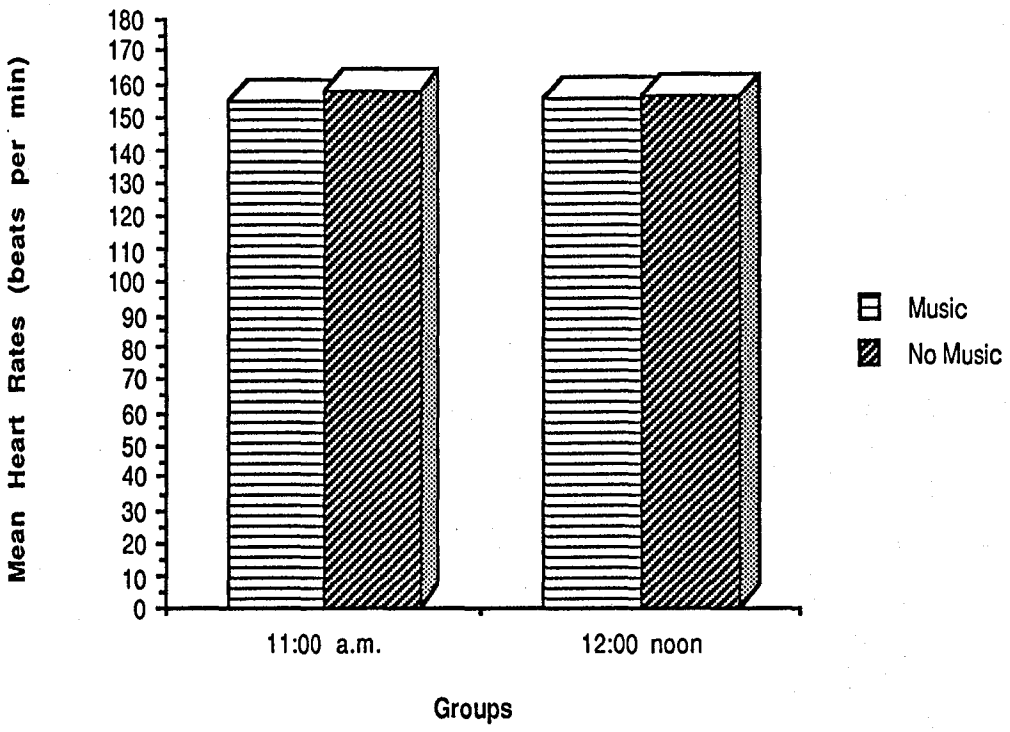

Figure 45. Heart rates with and without music for both groups.

No important differences were revealed between the two groups with mean heart rate measures of 156.5 HBM for the 11:00 group vs. 155.8 HBM for the 12:00 group. Further exploration of the heart rate measures was abandoned due to the consistency of heart rates between running days, groups, and music conditions.

ANOVA for Heart Rate Measures

The ANOVA for the heart rate measure confirmed the observation that the presence of music while running did not increase one's heart rate. The ANOVA also did not reveal significant main effect differences between the 11:00 and 12:00 groups, nor was the group by music variable interaction significant (see Table 3 for the summary of

ANOVA).

Table 3

Summary of ANOVA for Heart Rate Dependent Measure

Source	SS	df	MS	F	p
1. Group Time	3.8	1	3.8	.03	.83
2. Subjects within groups	1735.2	16	108.4		
3. Music	28.8	1	28.8	.89	.36
4. Music X Group	15	1	15	.46	.51
5. Music X Subject within groups	518.1	16	32.4		

Correlation Between Rated Enjoyment Scores and Running Times

Results of a Pearson *r* computed for perceived enjoyment and running duration revealed a tendency to run for a longer duration when perceived enjoyment scores were high ($r = .33$), although it was not significant at the $p = .05$ level.

Exercise History Questionnaire

Current Exercise Habits

Criterion for participation in the study. The data collected from the exercise history questionnaire, which was given during the second week of class, was used to select participants that were non-athletes and not excessive exercisers. The criterion established for rejecting participation in the study was: exercises more than three times per week at a duration of more than 60 min.

Overall responses. The participants selected according to the frequency of exercise comprised: 7 participants who were not involved in a regular aerobic exercise program before the onset of class (indicated regular exercise only for the past 2 weeks or less), 1 participant who exercised 1-2 times per week, and 10 participants who exercised 3 times per week. The duration of exercise reported by these participants were: 7 participants who were not involved in regular aerobic exercise before the onset of class, 1 participant who exercised for 15-20 min, 4 participants who exercised for 21-30 min, 1 participant who exercised for 31-45 min, another participant who exercised for 46-60 min, and 4 participants who exercised for more than 60 min. (They were selected because they did not exercise more than 3 times per week.)

11:00 group. The 11:00 group was comprised of 4 participants who did not engage in regular aerobic activity before the onset of class, and 7 participants who exercised 3 times per week. In terms of running duration, 7 participants did not exercise before the onset of class, 1 participant exercised 15-20 min, 3 participants exercised for 21-30 min, 1 participant exercised for 31-45 min, another participant exercised for 46-60 min, and 1 participant exercised for over 60 min.

12:00 group. The 12:00 group reported exercise frequencies of no regular aerobic activity before the onset of class for 3 participants, 1-2 times per week for 1 participant and 3 times per week for 3 participants. According to reported running durations, 3 participants were not regular exercisers, 1 exercised for 21-30 min, and 3

exercised for 45-60 min.

Previous Exercise Habits

Overall responses. Two of the participants selected had never attempted an aerobic exercise program before enrolling in the class. One participant had attempted to exercise, but lasted less than 2 weeks. Four participants lasted 2-3 months with a previous exercise program. Another 4 participants maintained their exercise programs for 4-5 months. Two participants engaged in exercise for 6 months to 1 year. Another participant engaged in the activity for I year. Four participants lasted over 1 year in a previous exercise program.

11:00 group. Two participants indicated they had never attempted to engage in a regular exercise program before and the remaining 9 participants reported they attempted exercising before; 1 participant lasted 1 month with the program, 2 participants lasted 2-3 months, 3 participants lasted 4-5 months, 2 participants lasted 6 months-1 year, and 1 participant lasted over a year.

12:00 group. All of the participants in this group indicated that they had attempted a regular exercise program before; 1 participant lasted less than 2 weeks with the program, 2 participants lasted 2-3 months, another participant lasted 4-5 months, and 3 participants maintained their program for over a year.

Individual Responses in Relation to Running Enjoyment and Running Time

An individual's current or previous exercise habits did not appear to have an influence on rated running enjoyment or running time.

Consistent increases or decreases in rated running enjoyment or running time did not appear to vary with specific physical fitness levels or with previous attempts at exercise of any length (see Table 4 for individual responses on all 3 measures).

Table 4

Participants' Exercise History, Rated Enjoyment Scores, and Running Times

Participant	Exercise History Questionnaire				Rated Enjoyment Scores	Running Times
	Current Exercise			Previous Exercise		
	Frequency (per week)	Duration (minutes)	Length	Length	+= increased with music -= decreased with music *= consistent increases ^= consistent decreases ~=inconsistent	
1	3X	15-20	6mo-1yr	4-5mo	+13.6*	-.3~
2	none	none	none	none	+ 6.3~	+1.4*
3	3X	21-30	2wks	6mo-1yr	-17.5~	-6.8^
4	none	none	none	>1yr	+.63~	+2.2~
5	3X	21-30	2-3mo	2-3mo	-37^	-117^
6	3X	31-45	>1yr	6mo-1yr	+17*	+1.7*
7	3X	21-30	4-5mo	4-5mo	+17.3~	+3.5~
8	3X	15-20	6mo-1yr	2-3mo	+79*	+.5~
9	3X	21-30	2wks	1yr	+11~	+1.3*
10	3X	>60	4-5mo	none	+23.5*	-.7~
11	3X	46-60	>1yr	4-5mo	+4*	0 (same)
12	3X	21-30	2-3mo	2-3mo	+27*	+.7~
13	2-3X	31-45	2wks	4-5mo	+11.7*	+6.6*
14	3X	46-60	>1yr	>1yr	+30.6*	+5.9*
15	2-3X	31-45	none	<2wks	+22.2*	+10.6*
16	3X	21-30	2wks	2-3mo	+21*	+3.6*
17	1-2X	46-60	>1yr	>1yr	+4.7~	+1.1~
18	3X	46-60	>1yr	>1yr	+6~	-5.7^

Music History Questionnaire

Overall Responses in Relation to Running Enjoyment and Running Time

The frequency of listening to music outside of class time did not show a relationship to rated running enjoyment or running duration. Frequency was calculated for each group by participants' responses for Question I (how frequently they listened to music at home) and Question 2 (how frequently they listened to music in their car; if they owned one). Mean scores for Question 3 (whether it was more enjoyable to run with music vs. no-music), 4 (whether they perceived the run as longer with music vs. no-music), and 5 (whether they perceived exerting themselves less with music vs. no-music) were also calculated for each group. Both groups rated running more enjoyable with music vs. no-music with a mean score of 7.2 (1= less enjoyable, 9= more enjoyable), with the 11:00 group rating it even higher than the 12:00 group: 7.7 vs. 6.1. Both groups responded that they ran for a longer period of time with music than without music, with the 11:00 group giving a rating of 6.6 (1= shorter, 9= longer) and the 12:00 group giving an even higher rating of 7.0. The mean score for both groups combined was 6.7. The 11:00 group found they were exerting themselves more with music, mean score of 6.1 (1= less, 9= more), whereas the 12:00 group did not note a difference in exertion between the running conditions, with a mean score of 5.0. The combined group rating for exertion was 5.6.

Group Responses to Questionnaire

11:00 group. Responses to Question 1 (percentage of time spent

listening to music at home) were: 2 participants indicated less than 25%, 4 participants indicated between 25-50%, 3 other participants answered over 75% of the time, and 2 participants did not complete the questionnaire. Of the participants who completed the questionnaire, all but 2 (these 2 participants did not own a car) stated they listened to music in their car over 75% of the time. The mean score for the group on Question 3, whether they found it more enjoyable to run with music vs. no-music (1 = less enjoyable, 9 = more enjoyable) was 6.8. The mean score for Question 4, how long they found they could run with music vs. no-music (1 = shorter period of time, 9 = longer period of time) was 6.6. The mean score for Question 5, how much they found themselves exerting themselves when running with music vs. without music (1 = less, 9 = more) was 6.1.

12:00 group. Responses to Question 1 (percentage of time spent at home listening to music) were: 3 participants indicated less than 25%, 2 participants indicated 25-50%, 2 participants answered 50-75% of the time, and 1 participant did not complete the questionnaire. Two of the participants responded that they listened to music 50-75% of the time when in their car. Five participants indicated they listened to music in their car over 75% of the time. One participant did not respond to the questionnaire. The mean score for the group on Question 3, whether they found it more enjoyable to run with music vs. no-music (1 = less enjoyable, 9 = more enjoyable) was 7.7. The mean score for Question 4, how long they found they could run with music vs. no-music (1 = shorter period of time, 9 = longer period of time) was

7.0. The mean score for Question 5, how much they found themselves exerting themselves when running with music vs. without music (1 = less, 9 = more) was 5.0.

Individual Responses in Relation to Running Enjoyment and Running Time

Individual responses to the music history questionnaire (See Table 5 for the individual scores on the music history questionnaire.) were compared against the rated enjoyment questionnaire scores and running times listed in Table 4. No relevant pattern was found of rated running enjoyment scores, running time, and music history questionnaire responses.

Table 5

Participants' Music History Questionnaire Responses

Participant	Music History Questionnaire				
	% of time listen to music		Enjoyment w/music	Time w/music	Exertion w/music
	At Home	In Car	(1=less, 9=more)	(1=shorter, 9=longer)	(1=less, 9=more)
1	25-50	>75	5	5	4
2	>75	>75	9	9	9
3	25-50	no car	6	7	6
4	>75	no car	9	9	9
5	25-50	>75	4	4	2
6	–	–	–	–	–
7	>75	>75	7	6	5
8	–	–	–	–	–
9	25-50	>75	6	5	6
10	<25	>75	8	7	7
11	<25	>75	8	7	7
12	<25	50-75	8	7	7
13	50-75	>75	8	7	7
14	25-50	>75	8	7	6
15	<25	>75	8	8	2
16	–	–	–	–	–
17	25-50	50-75	6	7	4
18	50-75	>75	8	6	4

Types of Music Used by Participants

The type of music used by the participant or by each of the groups as a whole did not influence rated running enjoyment or running duration, since almost all of the participants chose rock and roll music for their tape.

11:00 group. Nine participants used rock and roll music, 1 participant used easy-listening music, and another participant used a combination of rock and roll and country-western music.

12:00 group. Six participants used rock and roll music and 1 participant used country-western music.

Discussion

Based on the results, music enhanced the participants' enjoyment of running, but did not significantly increase their running time or heart rate. A number of situational and individual factors could have contributed to the non-confirmation of the last two hypotheses which will be discussed first, followed by a discussion of the implications of the first running enjoyment finding. Results of the exercise history and music history questionnaire will also be discussed in relation to the hypotheses.

Running Duration

Although the hypothesis that music would increase the duration of time spent running was not confirmed at the $p = .05$ level, the results indicated a tendency for participants to run longer or to stay at the same duration of running when using music compared to running without music. Only 3 of the 18 participants showed consistently decreased running times with music in comparison to running without music. The other 15 participants either showed a consistently longer running duration with music (6 participants), inconsistent running times between the two running conditions (6 participants), or stayed near the maximum 30 min running period regardless of the presence or

absence of music (3 participants). Also, according to the music history questionnaire responses, the participants indicated they believed that they ran for a longer period of time with music vs. without music. It appears then that the detrimental effect of music on running duration is slight in comparison to the potential benefits to be gained from such an intervention.

Increased Running Duration

Influence of enjoyment scores on increased running duration. All but 1 of the 6 participants who ran consistently longer with music, rated the run as more enjoyable with music vs. without music; the 1 participant had inconsistent ratings.* Results of the Pearson *r* computed for perceived enjoyment and running duration also revealed a tendency to run for a longer duration when perceived enjoyment scores were high although it was not significant at the $p = .05$ level.* This tendency to run for a longer period of time when the run is perceived as more enjoyable through the use of music lends itself to increasing exercise compliance. Whether an individual uses music or another form of intervention that makes running/exercise more enjoyable, the individual is more likely to stay with that program than with one that is aversive.

Influence of group differences on increased running duration. Physical fitness levels may also account for differences in running duration. Large significant differences of running times between the two groups were noted along with the observation that the 12:00 group tended to be in poorer physical shape in comparison to the 11:00 group.

Four of the 6 participants who ran for a longer period of time with music were from the 12:00 group. Of these 4 participants, 3 were in the poorest physical condition of their group based on their responses to the exercise history questionnaire. Direct observation of the 4th participant according to running pace and heart rate also revealed poor physical condition. These 4 participants also scored consistently higher on the enjoyment questionnaire while running with music. The other 2 participants who consistently increased their running time with music belonged to the 11:00 group. One of these participants was also in the poorest physical condition, based on the responses to the exercise history questionnaire, in comparison to the other members of their group. The relationship between poor physical condition and increased enjoyment when running with music suggests indicates that music can be used effectively to distract one's attention from the aversive qualities of beginning an exercise program: muscle soreness, distance of the run, and perceived exertion. The music may also have facilitated a smoother running stride and/or breathing pattern which allows for an easier execution of running itself.

Decreased Running Times

Influence of perceived enjoyment on decreased running time. Even when participants decreased their running time when using music, almost all of them did not rate that run as less enjoyable. Of the 3 participants that consistently decreased their running time with music vs. no-music, 2 of them were inconsistent with their ratings of enjoyment in each running condition, and only 1 rated consistently

lower enjoyment when running with music.

Influence of group differences on decreased running times. Factors that may have decreased the duration of running time were lifting weights the previous or same day (especially when working the lower body) and getting tired of listening to the same tape. These factors were specifically noted by the 12:00 group. One participant in the 12:00 group made several complaints of becoming bored with her tape and another participant, also from the 12:00 group, asked if he could use a different tape.

Other factors that may have influenced running times were noted during direct observation of each group. The 12:00 group tended to take exercise less seriously than the 11:00 group, which was evident by their mannerisms and comments before starting the run (e.g., stating that they were going to take it easy, speeding up to catch up with a friend, and having to be reminded that no talking was allowed).

Heart Rate

According to the results, the hypothesis that music would increase one's intensity of running or heart rate, was not confirmed. Participants' heart rates stayed relatively the same across both music and no-music conditions. This is likely because the participants were instructed to keep their heart rates within an aerobic heart rate range of 140-160 beats per min.

Enjoyment

The hypothesis that music would increase one's perceived enjoyment of running in comparison to running without music was

confirmed. The participants also indicated on the music history questionnaire that they found it more enjoyable to run with music vs. without music. This increase in perceived enjoyment of exercise during running sessions with music has implications for both initiating an exercise program and maintaining exercise as a lifestyle habit. Because music acts as a distractor from the adversities of "getting in shape" (i.e., muscle soreness, fatigue, lack of immediate benefits from exercise), focus is placed on the enjoyable aspects of music, thus providing an immediate association of enjoyment to exercise. Music can also act as a relaxation agent, and therefore can change a participant's pattern of breathing or running stride in a way that facilitates an easier execution of the activity. If a person enjoys physical activity more because of the association with the reinforcing qualities of the music, running itself will be viewed as a reinforcing activity. Making running more enjoyable in the beginning either through the distracting or relaxing qualities of the music itself will facilitate a positive association to running that will increase the likelihood that the activity will be maintained long enough to allow the exerciser to experience the long term benefits of engaging in a regular routine of exercise (i.e., increased physical fitness, increased feelings of well-being, etc.). Music can also facilitate maintenance of regular exercise behavior by providing variety to exercise through its continuous supply of new stimuli, thus alleviating boredom from a regular exercise routine. This is especially relevant with participants running laps around a gym-- a non-stimulating environment, but often

the only choice for exercisers. Music can also facilitate developing greater levels of exercise intensity and duration by distracting one's attention from perceived exertion and the fatigue associated with increasing intensity and duration of running. In addition, its relaxing qualities may provide a more energy efficient running stride. Satisfying both immediate and long-term outcomes then can increase compliance.

In summary, an ANOVA completed on running duration and the two music conditions proved to be nonsignificant for both groups combined. However, there were significant group differences with the 12:00 group running longer with music. Generally speaking, all but 6 participants in the study increased their running duration with music. Also, there was a tendency toward longer running durations when enjoyment questionnaire scores were higher, although this did not reach the $p<.05$ level. If one can increase an exerciser's enjoyment of the physical activity, there is a likelihood that the person will run for a longer period of time. Music was shown to significantly increase one's enjoyment of running, with almost all the participants but 2 showing increased enjoyment questionnaire scores when rating their run with music vs. without music.

Shortcomings of the Study

Influence of Heart Rate Measures on Running Time

Participants were instructed to stop and take their heart rate after every 1/2 mile or 9th lap. This directly affected their running duration. A more reliable running time based on fatigue could be

obtained if a treadmill was used, because heart rate could be monitored continuously without stopping the runner.

Group Effect

Participants were individually staggered by 1 min for beginning running times in an attempt to reduce the group effect. However, there was still a tendency for participants to end their run as a group, especially in the beginning sessions. Assessment of running time and perceived enjoyment during the two running conditions would be more accurate if the participants ran individually.

Boredom With The Same Tape

Two participants complained of using the same tape for every run that required music. Participants should have been allowed to change tapes since the focus of this study was on increasing one's enjoyment of running and not on the effect of different types of music on running performance.

Classification Of Music Selections

Although an analysis of the types of music used by participants did not reveal an influence on running performance, a more detailed classification of music selections may give more insight into the motivational qualities of the chosen piece of music. Raul Espinosa, president of Music in Motion, a service that analyzes music selections for aerobic dancing, states that there are many elements to good exercise music which can contribute to the music/exercise effectiveness such as number of beats per minute, how familiar the song is to the individual, and breaks in the rhythm and lyrical

arrangement (cited in Vogel, 1985).

Influence of Established Criterion for Participant Selection on Running Performance

The criterion that participants' not have a history of using music while running may have produced a unique population of subjects. Some of these subjects may have intentionally avoided running with music in the past and therefore negatively skewed the results for running duration and minimized the positive effect of music on rated enjoyment. Further assessment of why participants had not used music before while running would have clarified this issue.

Future Research

Participants in the study were selected partially upon the criteria that they not exercise more than three times per week and for a duration not to exceed 60 min. Physical fitness level may influence one's running duration or perceived enjoyment of running with music. Future research needs to focus on which levels of physical fitness would benefit most from the use of music and what primary function music would serve at the different levels (i.e., in the initial stages of exercise, music might be most beneficial and its primary purpose would be to act as a distractor from the fatigue and muscle soreness of beginning an exercise program).

Individual Motives for Exercising

Although almost all of the participants enjoyed running with music more than without music, future research should focus on the times when music is not enjoyable to the individual. Music may not be

desired if individuals want to focus solely on their internal bodily sensations to determine how their body is responding to the specific physical activity. Mood may also influence the person's reaction to exercising with music. It may be that music would be more beneficial to running when an individual is depressed vs. being in an excited state of mind. Music may also be used differently by athletes than the novice exerciser; athletes may use it to "psyche themselves up" before performing or during training to push themselves harder. In comparison, beginning exercisers may use it continuously throughout their workout as a distractor from pain and fatigue, or to help them to relax so they don't think they are working-out so hard. Music could be aversive to athletes who need to concentrate on their performance, just as novice runners may find music aversive if their motive is similarly on increasing performance, or if they are preoccupied in learning this new activity.

Longitudinal Study of the Effect of Music on Exercise Behavior

A long-term study examining differences in physiological measures (i.e., maximum oxygen uptake) with music versus without music may be more valuable in obtaining consistent or overall influences of music on exercise behavior than measuring daily running times, which can be influenced by daily fluctuations in running performance.

Music and Long-term Maintenance of Exercise

Future research also needs to assess the effect of music on the long-term maintenance of exercise behavior. Is music still positively reinforcing for an individual who is experiencing the benefits of

exercise itself? Of the persons who use music regularly with exercise, what is it that they like most about exercising to music? What were their initial reactions to using music with exercise?

Selection of Assessment Measures

Considering the feasibility of an individual running for a longer period of time when the run is considered more enjoyable to the individual, future research needs to examine different assessment tools in terms of their effectiveness in measuring running duration and enjoyment.

Variety in Music Selection

Future research also needs to examine how much music variety is needed for optimal enjoyment when used with exercise vs. the comfort of routine songs and established expectations.

Male vs. Female Responses to Music and Exercise

Considering the apparent popularity of aerobic dance among women in comparison to men, future research should be directed at which types of music would be more enjoyable to each of the sexes and whether music is more aversive for men while they are exercising than it is for women.

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Appendix A

INFORMED CONSENT FORM

By signing this form, I hereby acknowledge the following:

1. I have no medical conditions which would interfere with, or pose a danger to myself when engaging in physical exercise.

2. I have been informed of the fact that the study I will be participating in is being conducted by a graduate student of the University of the Pacific for the purposes of learning more about the effect of music on heart rate during exercise.

3. I have been further informed that I will be participating in six running sessions where I will be monitoring my own heart rate and will be observed by experimenters.

4. I have also been informed that as part of my Heart Exercise and Nutrition Class at the University of the Pacific I will be required to: (a) attend an orientation session; (b) participate in two running sessions a week during a three week period; and (c) complete the necessary questionnaires.

AGREED AND ACCEPTED: _____
Signature

_____
Date

NAME (PLEASE PRINT) _____

Appendix B

PERCEIVED ENJOYMENT QUESTIONNAIRE

This questionnaire is designed to determine your feelings about your run today. Please select the answer on the scale of 1-9 that most accurately reflects how you feel. There are no right or wrong answers.

Example:

If running always felt like it did today then _____.

1	2	3	4	5	6	7	8	9
I'm dreading my next run								I'm looking forward to my next run

An answer of "5" on the scale means that you feel neutral about running next time; you don't look forward to running but you don't dread it either.

1. I _____running today.

1	2	3	4	5	6	7	8	9
very much dislike								very much enjoyed

2. Tomorrow if I have another running experience like I did today then _____.

1	2	3	4	5	6	7	8	9
I dread it								I look forward to it

3. If my friends asked me how running was today I would tell them _____.

1	2	3	4	5	6	7	8	9
It was a chore								It was great

4. Running felt _____today.

1	2	3	4	5	6	7	8	9
awful								terrific

5. After running today, if I had a choice about running next time I would _____.

1	2	3	4	5	6	7	8	9
think about doing it								definitely run

6. When I stopped running today I thought _____.

1	2	3	4	5	6	7	8	9
I dread the next run								I can't wait until I run again

7. I thought running today was _____.

1	2	3	4	5	6	7	8	9
a drudgery								terrific

8. I felt a sense of _____ while I was running today.

1	2	3	4	5	6	7	8	9
anxiety								pleasure

9. Running was _____ today.

1	2	3	4	5	6	7	8	9
not enjoyable								enjoyable

10. All I could think about while running was _____.

1	2	3	4	5	6	7	8	9
how painful it was								how relaxing it was

11. If running was like this everyday I would _____.

1	2	3	4	5	6	7	8	9
not run								run all the time

12. Running today was like _____.

1	2	3	4	5	6	7	8	9
hell								heaven

13. If running always felt like it did today, then I would _____.

1	2	3	4	5	6	7	8	9
not want to fit it in my lifestyle								make it my number one priority

14. I would rate today's run as _____.

1	2	3	4	5	6	7	8	9
unpleasant								pleasant

15. After my run today, physically I feel _____.

1	2	3	4	5	6	7	8	9
drained								energized

16. Running today was _____.

1	2	3	4	5	6	7	8	9
like torture								blissful

Appendix C

Kappa Formula

For both the occurrence and nonoccurrence of behavior corrected for chance agreement among observers the formula for Kappa is:

$$K = \frac{\left[A - \frac{(A+B)(A+C)}{A+B+C+D}\right] + \left[D - \frac{(B+D)(C+D)}{A+B+C+D}\right]}{\left[A - \frac{(A+B)(A+C)}{A+B+C+D}\right] + B + C + \left[D - \frac{(B+D)(C+D)}{A+B+C+D}\right]}$$

In this formula, "A" represents both observers reflecting the occurrence of a particular behavior. "B" represents those intervals in which observer 1 rated the behavior as occurring while observer 2 did not. "C" represents those intervals in which observer 2 recorded the behavior as occurring while observer 1 did not. "D" represents both observers rating the behavior as not occurring. (Cited in Kent & Foster, 1977.)

Appendix D

Name_____

EXERCISE HISTORY QUESTIONNAIRE

The following questions concern your involvement with aerobic exercise. Aerobic exercise is any physical activity that uses the major muscle groups (legs, arms) continuously such as brisk walking, jogging, biking, swimming, skating, cross-country skiing, and dancing. Please answer the questions as honestly as possible by circling the most appropriate response for you. Your grade in this class will not be influenced by your answers since the instructor and T. A. s will not see this questionnaire. It will be used by a graduate student for the purpose of her thesis research. Your name will be used only to assign you to a running group during the lab portion of this class along with your permission for participation. You will be contacted in class regarding your participation.

I. I exercise aerobically _____.

a) I don't exercise at all

b) 1-2 times per week

c) 3 times per week

d) 4-5 times per week

e) 6 or more times per week

2. I have been exercising aerobically on a regular basis (at least 3 times per week) for the past _____.

   a) I haven't exercised regularly

   b) 2 weeks

   c) month

   d) 2-3 months

   e) 4-5 months

   f) 6 months-1 year

   g) over one year

3. When I exercise aerobically, I do it for _____.

   a) I don't exercise aerobically

   b) less than 15 min.

   c) 15-20 min.

   d) 21-30 min.

   e) 31-45 min.

   f) 46-60 min.

   g) more than 60 min.

4. Before this class, did you ever attempt a regular aerobic exercise program (3 times per week, at least 15 min. in duration)?

   a) yes

   b) no

5. If you did, how long did you stay with the program?
   a) less than 2 weeks
   b) one month
   c) 2-3 months
   d) 4-5 months
   e) 6 months-1 year
   f) over one year

6. For the purpose of this study, would you be willing to engage in aerobic exercise only within the scheduled class time and not outside of class?
   a) yes
   b) no

7. Have you ever tried running with headphone music?
   a) yes
   b) no

8. If you used headphone music before while running, how often did you use it?

   a) during 75% or more of my runs

   b) during 50-75% of my runs

   c) during 25-50% of my runs

   d) during less than 25% of my runs

   e) I have not tried headphone music with running

Appendix E

MUSIC HISTORY QUESTIONNAIRE

The following questions pertain to the amount of music you usually listen to in general, and whether you perceived running as more enjoyable with music. Please answer the questions as honestly as possible. Your responses to this questionnaire will be kept confidential and there are no right or wrong answers.

1. When I am at home, I listen to music _____.
   a) less than 25% of the time
   b) 25- 50% of the time
   c) 50-75% of the time
   d) over 75% of the time

2. When I am in my car, I listen to music _____.
   a) I don't own a car
   b) less than 25% of the time
   c) 25-50% of the time
   d) 50-75% of the time
   e) over 75% of the time

3. When running with music I found it _____than running without music.

1	2	3	4	5	6	7	8	9
much less enjoyable			didn't make a difference				much more enjoyable	

4. When running with headphone music, I found that I ran for _____.

1	2	3	4	5	6	7	8	9
a shorter period of time			the same duration				a longer period of time	

5. When running with music in comparison to running without music, I found _____.

1	2	3	4	5	6	7	8	9
I was exerting myself less			it didn't make a difference				I was exerting myself more	

Appendix F

Heart Rate Lecture

The topics that were included in the heart rate lecture were: (a) effectiveness of exercising at an aerobic, 60-90% maximum heart rate vs. anaerobic, above 90% maximum heart rate level; (b) determining your own target heart range; and (c) how to take your heart rate during exercise using the carotid artery method. The participants were instructed to keep their heart rate between 140 and 170 beats per minute (or between 23 and 28 beats per 10 s, since they were required to stop and take their heart rate for 10 s after every 9th lap or 1/2 mile).

Instructions on using the carotid artery method to take a heart rate were as follows: (a) use your first two fingers to take your heart rate; do not use your thumb; (b) locate your coratid artery by placing your two fingers behind your right ear and sliding your fingers diagonally toward your chest until your are halfway between your collar bone and your ear; (c) count the number of heart beats you feel for 10 s; and (d) this number is your heart rate per 10 s.

Appendix G

Group Instructions

The 11:00 and 12:00 groups were instructed that "the running program will last 3 weeks with two sessions each week of 30-60 min in duration. You will be using a cassette with your favorite music in a portable headphone cassette player which will be assigned to you. You will all receive 10 min of warm-up exercises/stretches and then begin to run around the track. After every ninth lap, which is a 1/2 mile, you should stop at the clock and take your heart rate. Then tell your observer what it is. Do this after every ninth lap. Each of you should run until you feel tired and can't run anymore or until 30 min has elapsed. Don't worry about anyone else and how long they run. When you are ready to stop running, finish a complete lap here at the starting point, and hand in your lap counter. After giving your lap counter to the observer, take a questionnaire and fill it out. This short questionnaire concerns how much you enjoyed your run. When you finish it, return it to the box marked 'return completed questionnaires here.'

After returning your questionnaire, cool down on your own with some of the warm-up exercises/stretches you did during the warm-up. If class time has already ended you may leave. If class time is not over, continue with cool-down exercises. You will be running with music on randomly selected days. Regardless of the order you receive for getting music, you will be running 3 days with

music and 3 days without music. You will be following the same procedure for each of the running sessions; warm-up, running until you are tired and can't run anymore, reporting your heart rate to the observer after every ninth lap, turning in your lap counter when you can't run anymore, filling out the questionnaire and returning it to the appropriate box, and cooling down until class ends. The only difference between the sessions will be that on some days you will run with music and on other days you will run without music. You will also be running at different time intervals within the class period.

Lastly, I would like to emphasize that you do not run outside of the scheduled class time during the course of this study. This is very important because I need to be sure that everyone has the same number of opportunities to run. Running outside of class may also influence your heart rate and, therefore, it would be difficult for me to determine how music affects your heart rate during the scheduled running sessions. So please keep your running within the scheduled class time. Does anyone have any questions so far? I will now show you how to take your heart rate and record it to your observer and how to use the portable cassette headphones."